THE AMERICAN GAS LIGHT JOURNAL

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Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

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Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C. O. D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Thirty-sixth Annual Meeting, New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
SECRETARY'S OFFICE, 26 CENTRAL SQUARE,
EAST BOSTON, MASS., Feb. 7, 1906.

To the Members: The 36th Annual Meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Tuesday and Wednesday, February 20th and 21st, 1906.

The following papers have been prepared:

"Thermic Consideration of the Retort Bench," by Mr. D. D. Barnard, Worcester, Mass.

"Gas Works of the Charlestown Gas and Electric Company as Remodeled in 1905–6," by Mr. Samuel J. Fowler, Charlestown, Mass.

"Some Notes on Mechanical Coal and Coke Handling Devices," by Mr. Holyoke, Springfield, Mass.

"Records of Street Work as Kept at New Haven," by Mr. H. E. White, New Haven, Conn.

"Effect of Gas Burning on Atmosphere of a Room," by Mr. A. P. Beardsley, New Haven, Conn.

Report of Committee on Electrolysis.

The following questions have been sent in for discussion:

"Naphthaline?"

"Methods and appliances for competition with electricity?"

"Second year's results with deep purifiers?"

"Why do American coals yield so much less ammonia than English and German coals?"

"Best method of quenching coke?"

"Best method of applying Bristol gauge to a gasholder?"

"Should a gasholder out of use be up or grounded? Contain gas or air? Crown be open or closed? No heat to prevent freezing?"

"Are there any rotary meters in use in the United States? Percentage of accuracy and cost as compared with ordinary meter?"

"Is it desirable to diminish the supply of water to the washbox on water gas set while making the run? What would be the effect on the tar or the efficiency of the oil?"

"What is a quick method of determining the amount of naphthaline in gas?"

"To what depth is the lead in a hub joint compressed by calking? If not compressed for more than portion of its depth, why is it necessary to use lead to the full depth of the joint? Should lead be deeper in a 36-inch than a 6-inch joint?"

"Is it customary to have bye-pass connection around the purifiers?"

"What items go to make up the cost of gas in the holder, and what should be the percentage of each item?"

"Should gas show free from sulphur on using a continuous 24-hour test?"

"In working a water gas set only 10 hours out of every 24, what should be the efficiencies with a modern 6 feet 6-inch setting, using a good grade of coal and oil?"

"Have any members used tar for enriching in a water gas set, and if so with what results?"

"Is the use of air desirable in the purifiers, and, if so, what per cent. is necessary to obtain the best results?"

"Which gives the better results with water gas, a 'P. & A.' or a water gas washer?"

The members will dine together as usual at 6:30 on Tuesday evening. Please note change of dates on account of Thursday being a national holiday.

LIBRARY OF CONGRESS SMITHSONIAN INSTITUTION

Application blanks for membership may be obtained of the Secretary.

All friends of the Association are cordially invited to attend the meetings and take part in the discussions, whether receiving a formal invitation or not. N. W. GIFFORD, Secretary.

[NOTICE.]

Wrinkle Department, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF THE WRINKLE DEPT.,
719 CITIZENS BUILDING,
CLEVELAND, O., June 13, 1905.

The Wrinkle Department of the Ohio Gas Light Association is now ready to receive contributions for the 1906 collection, and a sketch or description of all devices, formulæ and methods of accomplishing objects pertaining to the gas business, is respectfully solicited.

Please send a written explanation, accompanied by any sketch, photograph or drawing, to the above address, or a description alone will suffice.

Hoping to receive prompt compliance,

Yours very truly, W. E. STEINWEDELL, Editor.

[NOTICE.]

Fifth Annual Meeting, Wisconsin Gas Association.

WISCONSIN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
RACINE, WIS., January, 27, 1906.

To the Members of the Wisconsin Gas Association: The Fifth Annual Convention of the Wisconsin Gas Association will be held in Milwaukee, on Wednesday the 14th, and Thursday the 15th, of February, next. Headquarters will be held at the Hotel Pfister where rates will be $1.50 and upwards per day for rooms without bath, and $2 50 and upwards for rooms with bath; all European plan. The best rooms can only be obtained by making reservation in advance of the meeting.

Arrangements have been made for a dinner at the Milwaukee Athletic Club, for the evening of Wednesday the 14th, and a theater party at the Davidson Theater for the evening of Thursday the 15th.

Respectfully yours, HENRY H. HYDE, Secretary.

BRIEFLY TOLD.

DEATH OF MR. ADAM KELLER.—We regret to have to report the death of Mr. Adam Keller, one of the incorporators of the Columbus (Ind.) Gas Light and Coke Company, and its President for 33 years, who died at his home in Columbus the morning of January 23d. Born in Franklin county, Pa., October 14th, 1831, twenty years later he settled in Springfield, O., and engaged in the carpenter's trade. In 1856 he became a permanent resident of Columbus, and in its growth he was a prominent factor. Indeed at his death no other man in that city was more widely known or more respected. His direct survivors are his sons, C. M. and W. P. Keller, and his daughter, Miss Mary Keller. His charities were many, and not of the advertised sort.

DEATH OF MR. HERMAN POOLE.—Mr. Herman Poole, a widely known chemist (in fact his reputation was international), died at his home in this city last week. He was born in Boston, December 24th, 1851, and had been an expert metallurgist for over a quarter century. He was best known to gas men through his treatise entitled "The Calorific Power of Fuels," the first edition of which was published in 1898, by Messrs. John Wiley & Sons, of New York. He was held in good esteem by his confreres, and it is a pity that his genius was somewhat clouded by his environment. His wife survives him.

NOTES—

THE selling rates at Newton, N. J., are hereafter to rule at $1.45 on illuminating and $1.20 on fuel account.

A GAS plant for Opelika, Ala., is being considered. In our belief the time is not ripe.

MR. JOSEPH LUSH, Sales' Manager, New York Improved Meter Company, New York, reports having closed a number of contracts for the Company's goods during the past few weeks.

[Prepared for the JOURNAL by "OBSERVER."]

Extension of the Use of Gas in the Trades.

The rapid development of the uses of gas in fields heretofore untouched is attracting the notice of gas manufacturers and others interested in its distribution. Condensed cases are put up in cylinders for purposes of transportation along with the apparatus to be operated by the heat or power generated therefrom. The manufacture and sale of hydrogen and oxygen gases condensed are now firmly established as a regular business in many of the leading cities. The object primarily of putting the gases up in metallic cylinders was to meet the demands of the users of the gases in stereopticon and moving picture machines. Then the condensed gases were introduced in compact cylinder form for lights for exterior purposes, such as for fairs, circuses and for outdoor industrial work. Where night work is in progress on buildings the gases put up in cylinders are often used. I saw gas lights furnished for night work in a quarry with good results. On another occasion night work was in progress on the erection of a wharf at the water front and condensed gases were utilized with proper burners for making the light for the workmen. The manufacturers furnish the gases in strong metal cylinders in which the gases have been compressed many atmospheres by means of powerful steam force pumps. It has been shown that the gases may be kept in these cylinders for a long time without liability of deterioration.

The cylinders are constructed to hold 25 to 100 cubic feet of condensed gas. The handy, 25-cubic foot size, weighs about 50 pounds, is some 40 inches long and about 10 inches diameter. In the cuts are shown some of the industries into which the condensed gases have been introduced. The grinder of shears, the popcorn man, the organ player and others have taken advantage of the power derived from gas operating devices and are deriving a good living therefrom. For example, I found one party doing a flourishing business in a vacant lot in a city. I could hear the dull puff, puff of the little gas engine. I looked into the vehicle which the man had and observed the plan of adjustment of condensed gas cylinder and engine as shown in Fig. 1. The cylinder containing the gas for the operation of the engine is marked *A*. This is adjusted just over the rear axle. A pipe *D* leads the gas from the cylinder to the gas engine, the cylinder of which is designated *C*. The gas engine is of the common type and operates the crank *D* by means of the piston rod and connecting arm. The power is taken from this lower wheel to the wheel of the grinding stone by the belt *A*. The manner in which a popcorn man has fixed up his corn popping arrangement is shown in Fig. 2. The wagon itself is made up in the standard form. Instead of the uncertain, greasy, dull oil jet for heating and popping the corn, this man had a regularly adjusted condensed gas tank as represented. This tank or cylinder is secured to the base of the body of the little cart. There are means of pumping the cylinder full of gas at required intervals. A pipe extends from the supply of the cylinder to the feed of the burner *E*.

The high pressure of the gas creates a blast at the burner, with the result that an intense light can be produced on a mantle or by means of a lime. If the latter is used, both the hydrogen and the oxygen gases are needed, or either can be used with one of the gases by means of saturators which are sold. Commonly only the one form of house gas is used by the popcorn man; but with his light he is able to attract attention and secure considerable business. If white, the entire square is lighted by his jets. If he uses colored shades, he can throw greens, reds, blues and other tints about and draw notice and custom to his output. One of the singular combinations called to my attention is shown in Fig. 3, consisting of a good-sized hand organ arranged on a platform on wheels and operated by a gas engine. The cylinder containing the condensed gas forms a part of the engine and is a support for the same. The working mechanism of the engine is of the ordinary gas engine design. This engine is not only utilized to play the organ and evolve the tunes while the vendor passes the hat, but with the same power the ingenious Italian is able to move quite readily over level roads. This is done ny the use of a bicycle sprocket and chain connection fitted to the driver of the engine and extended down to the wheel on the rear axle, as shown. The letter *H* marks the driver wheel; *G* is the link chain running from the sprockets of the driver to the lower or driven wheel *F*.

There are times when oxygen is needed in conjunction with ordinary illuminating gas, as, for illustration, in the case of the advertising man who uses picture machines. His combination is of the order shown in Fig. 4. The average gas manufacturer is hardly aware of the extent to which this custom of street advertising with gas lights is conducted. I spoke with several parties who devote their entire time and energies to

advertising firms in certain cities by means of pictures and advertisements on glass slides, using gas condensed in cylinders for making the light. These men go about the country securing advertising notices from firms, and, for stated sums per month, exhibit the advertisements on sheets put up in public squares. Attractive pictures are run with advertising at intervals, thus holding the attention of the crowd in the street. One of the convenient forms of tanks for special use on a vehicle is shown in Fig. 5. The tank is arranged to receive the gas through the inlet pipe, being forced through by the strong steam pump. The connections with the apparatus to be operated are made with the outlet pipe, and this pipe is furnished with the necessary check valve to control the flow of gas through the channel. The means of fastening the tank to a base are obtained by use of the metal straps *I*, *I*, the feet of which are lapped and bored for set screws; but it is not always possible to use the powerful steam force pump to fill cylinders. These pumps are not to be found everywhere.

Consequently, the smaller foot and hand force pumps are used in many cases, a drawing of which is exhibited in Fig. 6. Connection

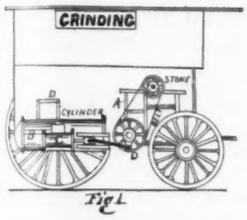


Fig 1.

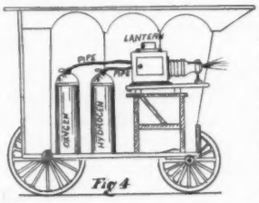


Fig 4

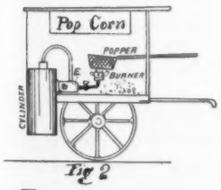


Fig 2

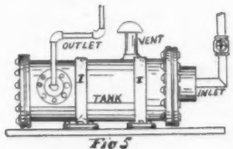


Fig 5

Fig 3

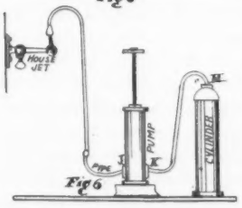


Fig 6

is made with the jet of the house or shop and a rubber tube is run down to the receiving pipe of the pump, as at *J*. The usual form of action is gone through by manipulating the hand rod and the downward stroke forces the gas through the pipe *K* into the receiving connection *M* of the cylinder. After a few minutes of hard pumping the gas is compressed fairly well within the walls of the metal cylinder and is ready for purposes of transportation. The hydrogen gas is purchased at less than 2 cents per cubic foot, while the oxygen gas, if also needed, will cost 10 or 12 cents per cubic foot.

The Dessau Vertical Retort Benches.

[Translated from the *Journal für Gasbeleuchtung* for the AMERICAN GAS LIGHT JOURNAL, by MR. FREDERIC EGNER.]

The past year has been one involving progress of importance to the gas industry through the introduction of a practical vertical retort bench, which is in successful operation at the works of the German Continental Gas Association at Dessau. It was a memorable event when, on September 20th last year, the well developed design of Dr. Bueb, Chief Chemist of the Company named, was opened for public inspection in the presence of some 80 practical and eminent gas men, representatives of the larger gas works of Germany and neighboring countries, and was thus thrown open to the professional criticism of the world. There were those who had been looking forward to this event in Germany with some impatience and great attention, as for years past endeavors to change the construction of gas producing ovens have manifested themselves, partly by employing very large, roomy retorts in the so-called coke ovens, and on the other hand by using standing retorts in the so-called vertical ovens.

Technical journals and patent pamphlets at home and abroad, especially in England and France, reported a number of proposals to that end, and it was no secret that experiments were underway at Dessau and Berlin from which decisive results might be looked.

The impression made upon the assembled professionals by the vertical retort benches, which had been in operation since the previous month of March, was altogether most favorable, and one could justly say that, while slow in coming, they were good and sure in action; or, to apply the aphorism, "A good thing takes time," as was manifestly the case in this instance. The stack, comprising 2 benches of 10 retorts each, with their generators and recuperators, appear as a solid, isolated block of most simple construction, whose heat radiation, compared with the usual horizontal or inclined retorts, despite the very high inside temperature, is strikingly small, since the vertical walls consist mainly of only poorly conducting masonry.

The heating apparatus, consisting of generator and recuperators, in direct and organic combination with the retort chambers, is readily accessible, and throughout practical in arrangement. The top and bottom lids allow coaling and the self-acting discharge of coke from the retorts in the smoothest and simplest manner.

The products of distillation are taken off horizontally near the head of the retorts, flowing directly into the hydraulic main, which is located in front of the bench, and in which, among other liquid contents, there is formed a thin tar. The attendance of the apparatus is extremely simple, two men being required, and the whole is rendered still more easy by means of mechanical coal and coke handling machinery. All the operations are conducted easily and smoothly, without trouble or interruption. That the inspection of September 20th was not dealing with a prearranged experiment, but with something of daily and regular occurrence, was plainly discernible, and this is further evident from the fact that the vertical retort benches, without any other aid whatever, had fully supplied the city of Dessau, with its 65,000 inhabitants, during the past summer months, and even now, after 7 months, during which these benches have been critically inspected by many professional men of the home and foreign lands, they are in constant and uninterrupted operation. One is justified, therefore, in saying that, by means of the Dessau installation, the problem of distillation of gas coal in vertical retorts has been in the most thorough manner possible studied and solved, and that, as mentioned in the closing sentences of Dr. Bueb's pamphlet, the Dessau vertical retort bench may now be offered to the public as trustworthy and well tried in working. Self-evidently it is not the intention to forestall, neither can a professional criticism be avoided by such a statement. On the contrary, a critical inspection of this, according to our opinion, very important object in the further evolution of our gas producing plants, is only greatly to be desired, and such a thorough examination said bench setting apparently need not fear, as the invitations to visit Dessau and freely inspect and publish the results found, would indicate entire confidence in the design and its steady practical operation at any and all times.

But when the leading English technical Gas Journal, our highly respected colleague, the *Journal of Gas Lighting*, publishes a set of articles which judge disapprovingly the vertical retort installation at Dessau and describes the trials with 5 m. long retorts at Berlin as a complete failure, we feel obliged to emphatically dissent, especially because these articles, evidently founded on insufficient information, have been widely circulated in foreign countries. The first of these articles, in the *Journal of Gas Lighting*, October 3, 1905, quoting the closing words of Dr. Bueb's paper, that he and those associated with him "Are now able to bring before the public and recommend the setting as trustworthy and well tried in working," remarks in connection therewith that "This statement is one which we feel bound to consider as showing a maximum of confidence founded upon a minimum of experience."

We, on the contrary, are of the opinion that rarely was any innovation, which so radically alters the method of manufacturing illuminating gas, pointing out a new way for greater development so exhaustively studied and tried, before a step was ventured upon to bring it to public notice. It must be self-evident that extensive trials and experiences had first to be gone through with, and a whole lot of doubts solved and prejudices overcome, before the goal could be attained. Appold's coke ovens, which had been mentioned as the pioneers of the vertical retort, and the unfavorable results of that time quoted may be stated as being an entirely misleading example. Directing attention to only a few of points. The opinion generally accepted was that vertical retorts were not suitable for the production of illuminating gas because, firstly, the walls of a completely filled retort with raw material would be burst by the swelling coke; and, secondly, because the illuminants of the gas would be destroyed by having to pass through the hot coke.

Although formerly direct, or grate bar, furnaces only were known, horizontal retorts had to be employed; but the introduction of generator gas furnaces admitted the use also of inclined distilling vessels. To

obtain uniform temperatures in vertical retorts at first met with difficulties, which had to be overcome in the knowledge of the object aimed at, by means of expensive trials, before retorts ranging from 4 to 5 m. (13.12 to 16 feet) in length were suitably and successfully heated. And in this way the Dessau Gas Company experimented for the space of 4 years with vertical retort ovens of various construction and design, some of which were in continuous operation for 6 months, during which they were carefully observed to obtain a knowledge of their weaknesses and learn the difficulties of the system, thus finding the means to overcome them. Upon that basis of 4 years of experience the new installation was erected and was furnished with all desirable conveying machinery, so that the supplying with gas of this somewhat considerable city could be undertaken with entire assurance. The trial of the security and worth in operation of the system has thus been fully demonstrated, and remarks on "A maximum of confidence with a minimum of experience" may hardly be made in connection with the facts. Concerning further critical remarks relating to yield of gas and fuel, in which respects the new method did not offer any decided advantages compared with the results obtained from the operation with the best horizontal and inclined retorts, it should be noted that comparisons between the vertical and other retort systems must be made with entirely different objective points in view: Greater simplicity in attendance, quantity and quality of coke, removal and recovery of ammonia and tar, quality of the latter; also, measurably great reduction of naphthaline, together with altogether satisfactory condition of the gas as to quality, quantity, heating value, etc. Not the recovery of product or fuel required makes the balance economically considered in favor of the vertical retorts, but the extraordinary simplicity in operation and great producing capacity per unit of labor, to which the material improvement in quality and quantity of by-products, may be added as of equal value. A gas engineer will scarcely need an explanation what an important advantage is offered by the elimination of thick tar, stopped standpipes, and a reduction of at the least 50 per cent. in naphthaline production to the economical management of any gas works, together with a substantial increase in ammonia recovery.

That these advantages are due to the method of carbonization we not only find important statements in corroboration in Dr. Bueb's pamphlet, but the experiences with by-product coke ovens also afford instructive information on that subject. We beg leave to recall in this connection the valuable contribution which Herr Hilgenstock read at our Duesseldorfer Annual Meeting (German Association of Gas and Water Business Men, 1902), concerning the occurrences going on upon the inside of the gasing contents of a coke oven.

He explained how by means of experiments it was found that the decarbonization of coal inside of the retort goes on; how the extraction of gas proceeds, beginning at the coal next to the walls of the retort, and proceeding gradually toward the midst of the contents, forming a ring of coke upon the surface next to the retort wall, and how at first volatile products are precipitated in the kernel of the mass and are gradually expelled in the course of the process of distillation, while the gases make their way out through the relatively cool inner zone, without being subject to serious breaking up. The recorded observations of temperatures during the gasing period in that experiment, taken in various sections of the coking mass, supply an interesting complement and confirmation of Dr. Bueb's detailed statement concerning his process and explanation and criticism of the ordinary gas retorts as used at this day; how some of the valuable constituents of illuminating gas, but especially ammonia, are broken up and destroyed by coming in contact with the hot walls of the retorts, evidenced by the carbon deposits thereat, and in which he gives a valuable pointer for this fact, that with the introduction of the vertical retort a prospective way had been discovered to improve the production of gas. As previously mentioned, elsewhere too, especially in England, work is underway to solve the problem of carbonizing coal in vertical retorts, and we will mention here particularly the systems of Settle-Padfield and Woodall-Duckham, which are mentioned in the articles of the *Journal of Gas Lighting* with favorable comments as to their advantages. So far as we know to the current time there are no reliable data to be had as yet, since they are still at least partly in the realm of experiment. The figures given as to yield of gas and illuminating power, so far as known, cannot stand a serious examination, and must have been based upon imperfect observations. At any rate, the interest for that system appears to have greatly waned among English gas circles and, notwithstanding that a bench of these is to be erected at the Cleesthorpes gas works, we cannot get warmed up to any great degree of favor for a method of gas manufacture which consists in throwing small quantities of dust coal into glowing retorts and hold with our English fellowcraftsmen that the whole system is not evolutive. The process of Woodall-Duckham consists, according to the English patent publications, in the production of illuminating and water gas, hence a gas mixture of low illuminating and calorific value that cannot either be brought into direct comparison with the Dessau coal gas system; but as it is understood that at Bournemouth the erection of this system is being pushed with energy to perfect it one may soon expect to hear more about it. Frankly admitted, however, we have more real confidence and feel a greater interest in the Dessau vertical retort system. Having now been in constant approved, uninterrupted operation for 7 months, it is at the present date being given a further trial at the Mariendorf works at Berlin, under the direction of Herr Körting, by an additional building of retorts 5 m. (16.4 feet) in length.

After what we have recently seen and heard there we have no doubt whatever that these 5 m. long retorts will also stand the test most successfully. For the Dessau vertical retort system this will lay a broad foundation, upon which, as we confidently look for, our gas industry now being engaged in a hard fight, will, in the coming years, arise to acquire new laurels, and with renewed strength proceed to further development.

Address of the President (Mr. William J. Clarke, New York), of the National Commercial Gas Association, on the Occasion of Its Meeting in New York City, January 24th and 25th, 1906.

Since it was proposed to organize an association of the commercial gas men, and by commercial gas men we mean, as we have set forth in our Constitution, "Any person who is qualified to assist in promoting the objects of this Association," and these objects are stated in part to be "The promotion of increased sales of gas and the promulgation of ways, means and methods necessary thereto"—certainly a broad clause so far as eligibility for membership is concerned, and certainly a broad scope for work—the question has been asked: "Is there any good and sufficient reason, in the face of the existence of the several gas light associations, for the organization of this new association? Is there any room for it? What work can it accomplish which cannot be done as well, if not better, by the existing gas light associations? Now, to give an answer to these questions, it is necessary to review, briefly, the work done by the gas light associations, to look into the status of the commercial gas man as a member of the gas light associations, and find out what there is in the work which these organizations accomplish which would interest the commercial gas man.

Now, I hold that the object in view in joining an association is, or should be, first of all, the holding of conferences on subjects in which all of the members may take part, and this means that the applicant for membership feels that desirable information is more easily obtained by joining an organization than by individual work outside of it; that is to say, the first object is conference on subjects which will result in mutual benefit.

Now, following out this thought, it goes without saying that the subjects which are discussed must interest the several elements of which the association is made up, and following out old lines the gas light association did this for the reason that these associations as originally constituted were almost exclusively made up of gas manufacturers, who naturally had only the engineering and technical problems to solve, and their efforts were all along these lines.

Now, the conditions have changed, but apparently the gas light associations have not. A new factor has developed in the gas industry, and it is conceded that it is an important factor, the commercial gas man in the form of manufacturer, buyer and seller of gas appliances.

This commercial man is becoming more largely interested in the gas light association each year, but as a rule he is relegated to an inactive or associate membership, with the result that he takes practically no part in the proceedings of these associations and hears little of interest to him at the meetings.

A review of the programmes of the papers read and subjects discussed at the sessions of these associations shows that the matters discussed were almost exclusively on engineering and technical problems. Now, understand that this must not be understood as spoken in the spirit of disparagement of the work done by these associations, but rather to show that, according to the voluntary admissions of some of the most earnest workers in the gas light associations, it is impossible for them to take up the commercial problems, and I am quoting one high in authority when I say:

"The solving of the engineering and technical problems is so large a part of their work as to almost positively preclude the possibility of

their taking up any of the commercial problems of the gas industry.' Now, as this is admitted by those in official positions in these associations to be the existing condition of things, and the prospect of their being any material change in the conditions being rather a remote one, the necessity for such an organization as the National Commercial Gas Association becomes apparent, and is emphasized by the recent marked accession to these associations of men who are looking for information pertaining to the industry other than that of a purely technical or engineering nature.

Up to this time his experience has been disappointing. He attends sessions of the various gas light associations, and in some cases is a member of several of the associations, but aside from the pleasure his visit to the place of meeting affords, and the taking part in the social features of the occasion, there is little to interest him, and I think that any of the active workers of the associations are willing to admit the weight of this assertion.

It is not to be supposed that anyone who has watched the progress of the industry for the last few years will deny the prominent place to which the commercial gas man has attained in the movement, nor will he refuse to accord him acknowledgment as one of the most prominent if not the most prominent factor in the promotion of the industry today.

Now, from the nature of the gas man's training he is not, in the general acceptation of the term, a commercial man. His environment has all been rather hindering to the development of a commercial instinct. He was for years in the field without competitors. His goods practically made their own market without solicitation or advertising. They were better than anything else on the market, and his was the only shop in town where they could be bought, and the air of "take it or leave it" was predominant in his place of business. Now, this was not conducive to the development of commercialism in his makeup, and illy fitted him to meet what was in store for him in the way of competition.

This condition of things was all very well while there was no competitor in the field, and his path was an easy one and the gait a seemingly safe one, though slow.

But there was a rude awakening due the gas man. As one of our humorists has put it, "His finish was looking for his address." A young and energetic rival came into the field, full of enthusiasm and with "up-to-date" methods of business. He became perniciously active and made such a stir that the gas man "Sat up and took notice." We older gas men remember the shock this new lighting man gave us, and with the then existing appliances at hand we were poorly equipped to meet him. The old-fashioned flat flame burner, yielding but 4 to 5-candle power efficiency per foot of gas, was a poor weapon indeed to protect our interests with. I think the most optimistic gas man of that day felt that he was leading a forlorn hope, and that things were certainly looking most unpromising for him.

The gas man realized that no radical change in manufacture could be made, his cost of production at the works was very near the minimum, and the outlet for his product was almost entirely restricted to the lighting field, and his medium for distributing light was of the crudest type. He saw his business rapidly getting away from him, but his salvation for the time being was at hand, and here the appliance man comes prominently into view, for although we can hardly class the discoverer of the mantle lighting system as an appliance or commercial man, still he was not a gas engineer, and the industry profited by the labor of one who started the commercial man in a field which he, the commercial gas man, has developed wonderfully.

In the time of the gas man's direst straits a wizard in the person of Dr. Carl Auer von Welsbach stepped forth from the laboratory, touched with his magic wand the gas man's product and increased its worth in light giving efficiency four to five hundred fold.

Surely this was a revolution. It saved the day for the gas man. And yet I presume there are some of you here to-day who can remember hearing the gas man at that time express the opinion that the Welsbach lamp was a dangerous factor to trifle with, for if it could accomplish what was claimed for it, would it not unduly reduce the monthly gas bill and cut off revenue? But notwithstanding these arguments of the more conservative gas man, the flat flame burner was rapidly displaced by the incandescent mantle lamp and gas arcs were devised and put into successful competition with the electric arc, the commercial man was on the field with his advertising and in his travels was doing missionary work which was worth thousands of dollars to the gas man and the gas industry, for it is conceded that the gas appliance man or the commercial gas man cannot push his own business without incidentally promoting the gas industry. So much for the commercial gas man's accomplishment in the lighting field and his claim for recognition there.

But notwithstanding the advent of the incandescent system of lighting and all the energy and effort put forth by the gas man, the electric light was making serious inroads in the "gas man's send-outs." The units of sales per meter were gradually but surely lessening. And the gas man must take on more commercialism if he would keep to the front. His curve line charts showed a daylight line that proved for many hours of the twenty-four his plant was earning no money. He began to realize that a new maxim must be learned, and he adopted this one: "Increased consumption means reduced cost per 1,000," and a most profitable maxim it is.

But here again I think a large amount of credit must be given to the commercial gas or appliance man. He was in the field and had already taken the initiative in the matter of advertising and promoting his business and with a generous expenditure of energy and money was pioneering in new fields. He spent thousands of dollars in experimental work, cudgelled his gray matter over new devices in which gas might be used as fuel for domestic and industrial purposes. Evidences were apparent of the appliance man's energy and enterprise, and this is the man who was the largest factor in making the daylight line of the send-out chart alter, and his missionary work as he travels about preaching gas as a fuel is accomplishing for the gas industry a work the worth of which could be hardly computed if looked upon in the shape of advertising.

So much for the claim of the commercial man for a hearing in the industry. Does he get it now? And is he likely to get it under existing conditions that govern gas light associations?

I quote from the address of President Lloyd, of the Michigan Gas Light Association, who, in his address at the Detroit meeting held this year, said:

"On all sides we hear complaint of our gas associations; that their proceedings are tame and uninteresting; they do not recognize that the conditions which brought them into being are modified or past."

Quoting further, President Lloyd said:

"The year has passed—not marked by any unusual advance in production. The commercial development has made such strides in the last few years that it may be looked upon as having been revolutionized."

Commenting on the proposed organization of the Gas Institute, he says:

"The scheme does not offer methods intrinsically different from those which are now obtained, with regard to which there is a fairly well defined opinion that they are insufficient. That our existing organizations do not meet our present necessities is obvious to the most casual observer."

Is this not because of the advent of a new element into the gas industry? The commercial gas man has brought about a new demand on the time and attention of the gas man and his association. There must be some room made for him and some time given to the discussion of matters interesting to him. And if, as it is claimed, this is not in the possibilities of the existing associations, then he must bring this about in some other way, for it is without question desirable that his matters should be taken up looking to the promotion of his end of the industry—methods of advertising, the experience of members of his guild who knew of successful methods as well as unsuccessful methods should confer with those who have tried both or neither, and by co-operation and advice create enthusiasm and devise new methods for output.

There are many considerations due the commercial gas man from the gas associations. First of all, he is entitled to a standardization of his appliances. This is not only important to him, but to the buyer, the seller and the user of the appliances. Under existing conditions he is in the peculiar position of having his appliance commended and accepted in one place and completely condemned and refused in another place, where to him apparently the same conditions exist, and yet he is told that his appliance is efficient in the one place and does not come up to the requirements in perhaps the next adjoining town.

Is it not due to him to establish some uniform standard of efficiency and give him some idea how that standard is determined? As it is now, he seems dependent entirely, so far as the judging of the efficiency of his appliance is concerned, upon a mere matter of personal equation, and this is most unsatisfactory to everyone handling the appliance, from the founder to the user.

Then again, the matter of misrepresentation by salesmen through ignorance or intent will be curbed. In the absence of authoritative

figures for quotation, the seller and buyer are often misled as to what is right to claim in the matter of efficiencies, and the misleading statement of the zealous salesman is transmitted to the user with the assurance that it will do thus and so, and when it falls short of what has been promised for it, trouble follows, and not only is the immediate user disappointed, but the prejudice which is made is far-reaching in its effect and perhaps spoils the sale of many like appliances. If the gas association man would set the gas appliance man right in some of these important questions, his, the gas man's troubles, would grow proportionately less.

There are many other matters that could be discussed at a conference of the gas man and the gas appliance man to the advantage of both. Methods of advertising, advantageous ways of displaying goods, best ways of demonstrating, how to do the best educational work among gas consumers, and many other subjects looking to the interest of both engineer and commercial gas man.

These are in part what could be talked of at a joint meeting of the associations and at a meeting of the commercial men if it were deemed advisable to hold one independently of the gas men. There are many subjects which the appliance man and the commercial gas man could talk over among themselves to advantage. Take, for instance, the standardization of such parts of a gas range as do not enter into the efficiency of the appliance. Why not make these parts more uniform and nearer interchangeable? Why have such a variety of flue collars, and why not have flue pipe diameters more alike? Settle the matter as to which is the better place for flue collars in a range—top or back. Look into the matter of overcoming down draughts reaching ovens. Devise some means of releasing gas from ovens in ranges that may have inadvertently accumulated there by careless handling of cocks; perhaps by having the pilot light cock throw the oven doors open. Why not discuss the matter of building ranges which are interchangeable in the matter of rights and lefts?

This, it seems to me, would be of great advantage to the gas company buyer, particularly in cities where the ranges are to be set in apartments and flats, where rooms are small and connections are difficult to make.

See if it is not practicable to devise some inexpensive but efficient diaphragm or float governor that may become a part of the fuel appliance, such a one as will hold say within a couple of tenths at the appliance with a varying service pressure of 2 inches. Such a device will be of great value to the user of the appliance and a means of great saving of time and money to the gas company where the maintaining of a uniform pressure at the house service is a physical impossibility. These adjustments of gas-ways are a source of great expense to the gas companies and a cause of great annoyance to the consumer and are worth considerable thought and attention.

These are matters that are completely crowded out of discussion at the gas men's association as they stand to-day. And these are some of the things to bring to mind when the question is asked: Is there any reason for the organization of a commercial gas association?

The hearty response with which the suggestion of forming such an association as the National Commercial Gas Association was received, offering as it does an opportunity to take these matters up, assures its success so far as numbers are concerned, but it should be understood that mere numbers in such an organization as this means but little. Unless there is hearty co-operation by all, little can be accomplished. The enthusiasm that is felt at a convention must be spread over the periods between meetings. Earnest work must be done between times by efficient committees heartily seconded by the entire association. Otherwise we will not make the work a success, and it should be brought home to each and every member that work and not the adoption of resolutions is what tells.

Now, there are various ways in which to go about the work. First of all, I believe the best results for the gas industry can be attained by co operating with the existing gas light associations, in arranging for joint meetings. It should be kept in mind that the gas light associations are bound to take a lively interest in our doings. They are perhaps more interested in us than anyone else is. Your success will incidentally mean theirs, and their success yours.

The matter of an exhibition is made much more feasible if you have the co-operation of the gas light association. It might be possible to have the meetings held in such a hall as would be suitable for exhibition purposes as well as a meeting room. The engineering man might hold alternate meetings with the commercial man, or the technical man might hold his meeting during the daytime, say in the exhibition hall, where the appliances would be readily accessible to him for examination, and the appliance man might hold his meetings in the evenings, and thus the lamp man could make an exhibition of his goods to advantage, and if the three evenings of the week were sufficient for the reading of the commercial man's papers and discussing them, the exhibition could be thrown open to the public and the commercial man could do some missionary work in the city where the meeting is held, and no doubt if it were properly advertised attract considerable attention.

These are some of the things that occur to me to be possible of accomplishment by the National Commercial Gas Association. Whether they can or not depends entirely upon the efforts of its individual members. The organization of such a movement is not difficult of accomplishment, but the carrying of it on is a different matter. It cannot be done without money, and perhaps that is not so difficult to get. Of more vital importance is the effort of earnest workers.

There should be a committee of energetic workers who should be designated as a Committee of Ways and Means. They should take up the matter of arranging for a date of the next meeting. If by reason of the organization of the Gas Institute it is deemed advisable to change the date set by the National Commercial Gas Association for its meeting, this committtee, or their representatives, should confer with the Committee on Amalgamation and learn the date of the next large gas association meeting and see what can be done in the way of co-operation with the gas association. Look up the matter of holding at the time of meeting a creditable exhibition of gas appliances for industrial and domestic use. See that arrangements are made by which the lamp men, as well as the stove men, are creditably represented and work out the details of bringing about what the National Commercial Gas Association has set out to do. Increase the gas sales, and surely to this work the gas association man should, and doubtless will, give his hearty and unqualified assistance.

I wish to reiterate that it must be understood that anything that has been said relative to the condition of things so far as the management of the existing gas associations is concerned is not to be considered as derogatory of their work, for we realize, as do many of the members of these associations, that it is simply impossible in the limited time of their sessions to reach even in a most superficial manner the subjects in which the commercial man is most interested.

What, then, is to be done with his problems? How and by whom can they be reached and intelligently and satisfactorily solved? I think that can best be done through just such an organization as the National Commercial Gas Association, and with the assistance of the existing gas associations or the proposed American Gas Institute.

I personally am in hopes that the work of the Committee of Amalgamation will result in the forming of an American Gas Institute, and I think that any movement toward bringing this about should have the hearty support of the members of this Association, for if it is formed I think it will be on the lines of the most progressive of the existing associations.

I quote from the president's address of one of these associations. He says:

"It is good that all of the departments of the industry meet periodically, for we are all dependent one upon the other. The manager's success in selling gas is largely dependent upon the efficiency and variety of appliances sold by the appliance makers, etc."

Further on he says:

"It is a question whether the commercial or the technical side of the business is to the fore. Now, he is addressing, as he says, 'Gas men in the broadest sense of the term,' *i. e.*, anyone engaged in an occupation identifying him with the gas business."

Notwithstanding all this breadth of eligibility qualification, the importance of the commercial end of the industry is acknowledged. The papers and discussion of the Association are almost exclusively technical ones. Of course, I do not refer to those most valuable contributions to the gas industry, the Question Box and the Progress Department, which are most instructive and evidence an immense amount of labor, time and money, and which are most admirably handled.

I refer more particularly to the papers read and discussed at the meetings and which to the men interested are the attractive part of meetings.

I think I have said enough of the purpose of this Association to make it clear that there is a field for it, and have made answer to the inquiry, "Is there a good and sufficient reason for the existence of such an association?" And if you are asked the same question again, which you undoubtedly will be, let your answer be given in no uncertain tone, nor leave room for doubt as to your individual stand in the matter.

The Relations of the Gas Man and the Gas Appliance Man to the Gas Industry.

[A paper read by MR. R. M. SEARLE, of Mount Vernon, N. Y., at the January Meeting of the National Commercial Gas Association.]

The relation of the gas man to the gas business is much like that of a father and a dozen sons who enter a dozen different professions; the father must guide each son through life to manhood and be a judge of, and be interested in each subject the son may call upon him to solve. To be a successful gas man he must love his business as he would love his sons, he must take the same active interest and do all his work with the same zeal that a father displays in educating his son.

The engineering end of the business, due to the enormous amount of energy, time and money spent during the last 50 years, has brought the art of manufacture and distribution to that stage of perfection where we must work harder than ever to effect further economies, especially when we consider that the price and production of the raw material are beyond our control. No matter how we figure it, sooner or later the cost of gas in any well managed plant will reach a minimum for that plant. When it does, a conscientious engineer is going to chafe, he bends every effort to use cheaper raw material, to find and install new and improved machinery, better regulations of the labor in hand, and then possibly succeeds in slightly reducing his costs; then he is confronted with a rise in first cost of raw materials, then his costs go up. Surely there must be a time when he will reach the culminating point, and in many works, with present processes, it has been reached. This fact has convinced more than one gas man, but it has not convinced some yet; if we are to continue to show a healthy progress more uses for our product must be found and more effort made to sell it. No doubt but that radical change in manufacture will be made in due time, but in the meantime we and ours must live; our stockholders have every right to expect dividends, and will not rest content until they get them. The small investor has placed his money in our care and he has every right to expect a fair return on his savings now; his confidence in us can only be held by our continuing to show substantial growth.

It is gratifying to hear, at the various gas association meetings, the best man in the business giving part of his time to the discussion of the possibilities of increasing the sale of gas. I want to bring out the importance and necessity of our taking more time to impress upon our subordinates, who, in time, become our successors, the "why" we do certain things. It is very disappointing at times to find young men, who become successors to men of much experience, undertake to lift themselves by their boot straps.

In the last few years I have had an opportunity of noticing the relation of young men to successful men who have graduated in our business. They are given certain duties to perform, with no explanation of "why" they are to perform them, or they are not properly instructed; they are given no data or reference to authorities for doing the work. Erroneous ideas are created in their minds, with great pecuniary loss to the company. Then you have to go to a very large expense to re-educate them properly, when they assume responsible positions in the gas business. I want to urge upon you again, to take more time to explain to the young man "why" certain things are given him to do. One of the best methods of educating the young gas man is the method carried out successfully by one company, which makes each young man, when given a particular job to do, make a complete written report upon it, and when the report is made, the managers discuss with him and other subordinates at the same time the work as carried out, how it has been carried out before, and "why" it was carried out. This method has helped materially in wiping out the increased cost of manufacture when subordinate is promoted to a manager, or sent to help out at another works.

I have noticed every time that a subordinate is promoted that a disappointing slump in operation costs obtains until the man gets his poise in his new position. These increased costs represent the cost to the gas company to educate its force. This cost could be largely avoided if the subordinate thoroughly understood "why" he was doing a certain task, when he was given it to do; this criticism holds good of the commercial gas man as well as the engineer. The results of the commercial man in the gas business show the same analytical thought, the same amount of hard work, and the same intelligent expenditure of funds as the engineering end. The man with good, sound commercial ability is bound to build up a company, and is bound to need engineers of the highest caliber. Here we see the great necessity of the manufacturing and commercial end bearing and forbearing with one another, to make the company a success. The engineer can materially help the commercial man by following such obligations as common sense will tell him the public demands. He can materially assist the commercial end by making all the details of the engineering end consistent with the necessities of the consumer: By giving ample pressure at various points in the system, uniform pressure, uniform candle power, anticipating drip pumping before consumers complain, polite and courteous answers to inquiries from consumers on gas commercial subjects; to get together with the commercial man and talk over the service, carrying out such suggestions as the commercial man feels are necessary for him to secure certain prospective new business. I will cite an extreme case: A commercial gas man had about closed with a consumer at the end of the line of a small gas main, for gas to be used in an enameling oven; upon investigation they found that enough pressure could not be obtained at end of this small line of main during average consuming hours of the day. He applied to the engineer, a pressure chart was taken for 24 hours, it was found that from midnight to 5 A.M. that ample gas could be secured to run an enameling oven, the commercial man knew that this concern had a night watchman, and being bright in his day and generation he suggested to the concern to enamel pieces in the day time and have the night watchman bake them after midnight. The system once installed gave perfect satisfaction and avoided the laying of a piece of large main.

If the commercial end of the business is handled by men of high commercial ability, the tendency, of course, is to require better and more engineers to manage the engineering branches.

As the commercial end of the gas business grows, the engineering end must grow with it. I have always felt that the commercial end of the gas business did not get the recognition that its importance entitled it to. Running over the list of papers to come before this meeting, shows that once a year we can expect at least six papers of great interest to gas men, who appreciate how necessary it is now to increase the output. When this meeting adjourns, I think those present will feel that two solid days spent once a year, considering the commercial end of the gas business unhampered by other obligations, will do more good in a shorter time than two papers read once a year spread over three years. If any return home from this meeting with added enthusiasm to hustle for more business, the meeting will have paid for its being. Many men will attend this meeting who only know what a gas association does by hearsay. Some commercial men and engineers, too, feel that they have no interests in common, with the result that one or the other stays away from the meetings. Could such a condition be worse? Eighty per cent. of the good of the meetings comes from contact with men at the meeting and by conversation between sessions, and over the dining table before and after the sessions, each swapping with the other his experience along the particular line of discussion that interests them for the moment. Valuable information can be secured quicker by having everybody directly and indirectly connected with the development of the commercial end say all they want to say, if they can feel that they are not trespassing on time that subjects foreign to their branch of the business are scheduled for.

The foregoing paragraph, in which I cited an experience with the enameling oven, firmly impresses upon me the importance of the gas company holding on to and controlling absolutely the sale of appliances. I do not believe any dealer in other commodities who might handle appliances as a side issue would have had experience enough to follow intelligently the line of reasoning displayed by the aforesaid commercial gas man—not that I think they lack the intelligence, but that their other interests are of sufficient importance to warrant their giving only a small part of their time and thought to overcoming difficulties that the successful operation of handling appliances requires. I have noticed a tendency of some companies to get away from the handling of the gas range business; this, to my mind, is bound to turn out disastrously.

I firmly believe that two companies, one handling appliances and one that does not handle appliances, would, if compared, show that the company that did handle appliances was giving the best service to the consumer, that more gas was sold per capita and per dollar of investment. The more gas sold the more proof it is that the consumers are being better treated and better taken care of. The consumer cannot and does not get service from the company that does not handle appliances that it gets from the company that does. A company handling appliances is bound to have a large amount of experience and a competently trained force which they are willing to furnish to a consumer promptly to his advantage, free of charge. For this reason alone they are in a position to give a better service than the company that does not handle appliances. A company that does not handle appliances is bound to have a minimum force, void of the experience necessary, and acquired

only by giving one's whole attention to the perfection of the service to each individual consumer.

The appliance man is one of the dozen sons I mentioned in the staring of my remarks. Giving the appliance men all the credit possible for the work they have done in the last 10 years developing such remarkably efficient appliances, they are still indebted to the gas man for the many valuable suggestions given them gratis, and for the many thousands of tests the gas men have made, even though their interests are mutual. The appliance men, I am sure, will continue to develop as fast as the gas business develops. If the appliance man will take hold of the spirit of this association, his relations with the gas business will continue to grow to the mutual benefit of all.

I do not recall my ever having a conversation, talk or visit from an appliance man from whom I did not derive useful information applicable to our business. It will be very gratifying to hear that this meeting has oiled up some of the different appliance men, who by virtue of their brains travel through the country, contact with other gas and appliance men, have stored up much information of value to us all.

New Business Methods.—A Query.—What Are the Best Methods to Employ?

[A paper read by Mr. J. D. SHATTUCK, of Chester, Pa., at the January Meeting of the National Commercial Gas Association.]

The writer has seen a virgin territory, quite well built up, without any gas supply to speak of, grow in 5 years to a consumption of nearly 4,000 cubic feet per inhabitant per annum, in a district almost exclusively residential and of a suburban character. Very few of the houses were piped for gas originally.

This territory has over 95 per cent. of the houses now using gas ranges, and a total of 1½ fuel appliances per consumer. A large numbet of these houses were piped by the company, and a great many by local plumbers. The company spent a great deal of money to get this business, outside of the cost of services, meters and stove connections, amounting to an average of about $5 per consumer, in advertising, canvassing and loss on bad debts, etc.

This business was built up with the use of liberal advertising, such as circulars, pamphlets, newspapers, display, etc., and the employing of about one canvasser to 15,000 inhabitants, and in busy season, perhaps one to 10,000 inhabitants. Later, this district was consolidated with an adjacent city, making the territory 13 miles long by 4 miles wide, having a population of practically 80,000 people, which is now covered by a canvasser to every 16,000 people. It is my belief that it would be profitable to employ one canvasser to 10,000 people in this district. I understand that in the city of Denver there is a canvasser to every 4,500 inhabitants, in Milwaukee a canvasser to every 6,000 inhabitants, and other cities range from 10,000 up to one canvasser to 50,000 inhabitants. The cities who have the largest number of canvassers seem to be selling more per inhabitant than those less fortunately equipped. A mere placing of canvassers to every 4,000 or 5,000 inhabitants will not bring the business, unless they are well selected men and are assisted with good advertising. Neither does it pay, in my estimation, to employ canvassers temporarily for 3 or 4 months. I believe that canvassers should be brought up and educated in the gas business to become experts in their line, and should feel that they are working into just as much a permanent position as a fitter, bookkeeper, or any other employee, and it is only through such confidence on their part that they will bring the best results. One of the most successful methods of handling canvassers has been employed by several companies, and one that gives the most satisfaction of any to the manager, is the assembling of the entire new business department for a conference each day or several times during the week. In our case, we include not only the new business department men, but the foremen of distribution and the head office man. All proposed work that the new business department may have in mind is talked over, and a practical way of doing the work is illustrated by the foreman of distribution, and the head of the office or accounting department is prepared to show where the profits or losses may occur from the office end. Once a week we discuss some particular appliance and compare the different makes.

Several years ago we felt that we could take a considerable loss to land a good consumer. This educated the people into demanding considerable free work from us. We have now adopted a new policy of trying to make all of this work self-supporting, covering all the small incidental losses of office, storeroom, general expense occasioned by such work, etc. This change in policy, together perhaps with business stagnation in our territory, resulted in practically a standstill of the company's business for a few months, but we soon found that the business was again moving forward on much better and more satisfactory lines, and that the class of business we are now getting is the kind that proved to be profitable as gas consumers when we were very much easier in our terms. At this point I would add I believe that a new company, taking hold of an undeveloped field, cannot afford to discriminate too closely between what is going to be good business and bad on account of the general advertising effect of having everybody shouting for gas. When your territory is fairly well saturated, then, I believe business should be developed along new and profitable lines.

The advantage of having a large number of canvassers, or, rather, a canvasser to a small number of people, is that each canvasser can be made a new business agent for his district, and cannot only gain new business, but prevent the loss of business that has already been obtained at considerable expense. I believe that all special complaints should be adjusted through the new business agent, who is responsible for his particular district, personally and as far as possible with little correspondence from the office.

We sent out this fall an elaborately decorated wagon containing all kinds of appliances, which made a call at every consumer's house, examined the service, burners, etc., put on new Bray burners where necessary, adjusted Welsbachs, and put on Welsbach goods at store prices, which was a little saving from our regular put-on price. The men on this wagon adjusted a great many sore spots and sold material enough daily, the profit from which more than paid their expenses and resulted in a large and continuous increase in the district, that we had thought was pretty well saturated. This proved to me conclusively that the place to do business with dissatisfied consumers is at the consumer's house. Adjusting complaints or burners was done under the eye of a new business agent or by his assistant, who was being trained as a canvasser, having had considerable practical knowledge in adjusting burners, piping, etc., before he was permitted to go into this field of work.

The industrial fuel appliance business has been pushed by only a few companies and is a large undeveloped field. Mr. F. L. Blyler, of Des Moines, Ia., read a paper before the Iowa Gas Association this year, in which he gives the average yearly consumption of a number of appliances as follows:

Appliances.	Average Consumption, Cubic Feet Per Year.
Rivet heaters	300,000
Hotel range	300,000
Meat branding machine	150,000
Tinning bath	300,000
Linotype machines	50,000
Gas forges	300,000
Gas bakery ovens	200,000
Gas steam tables	200,000
Enameling ovens	120,000
Confectioners' gas stoves	120,000
Popcorn poppers and peanut roasters	50,000
Brazers	75,000
Caldron heaters	120,000
Coffee roasters	Intermittent
Soldering furnaces	40,000
Gas arc lamps	24,000
Tailor iron heaters	40,000
Positive blowers	No. cons.
Laundry irons	18,000
Candy batch warmers	Intermittent
Gas manglers	50,000
Glue pots	40,000
Matrix dryers	Intermittent
Water stills	30,000
Soft metal heaters	Intermittent
Gas broilers	50,000
Cake bakers and waffle irons	Intermittent
China kilns	Intermittent
Hat steam presses	Intermittent
Incubators	10,000
Gas engines	60,000 per actual working horse power

We have introduced a good many of these appliances ourselves, and find his figures corresponding fairly well with our experience. We have added recently a number of fuel appliances that are burning from 100,000 to 500,000 a year, which cost us no more trouble and expense to connect than an ordinary house consumer. This business, however,

must be pushed by practical men, and supplemented with good advertising literature.

Mr. Blyler suggests the paying of canvassers 6 cents per 1,000 cubic feet for all new business turned in, estimating gas arcs 24,000 cubic feet per annum. I would suggest that the paying of ⅓ of this amount when business is landed, ⅓ half at the end of 6 months, if the business is held. In the case of an arc or appliance displaced a new one must be obtained in the district to offset this displacement. The canvasser to have a regular salary of perhaps $50 a month to pay for the general supervision of his district; the amount of the salary depending upon the possibilities of future business. Where goods are sold on credit, I would divide the amount; ⅓ when appliance is connected, ⅓ in 6 months and ⅓ when the appliance is paid for.

Six weeks ago we made up a few sheets of illustrated cuts of different industrial appliances, and sent them to all industrial concerns in our district, and received inside of two weeks, by return mail, a dozen inquiries, six of which brought in immediate business.

We adopted recently in our meter route books, four or five columns headed, services in, houses piped, gas range, water heater, store or house. When the new route books are started out once a year, the meter man puts a check mark in the different columns, according to what he finds in the house. We have little rubber stamps that indicate each one of these headings, and the consumers' ledgers have every house number entered, and opposite each house number this information is stamped with one of these little stamps. We thus have the entire information of our districts on our consumers' ledgers once every year. It requires very few extra lines in our ledgers to carry the idle services or houses not burning gas, as in several of our towns every house has a gas service, and in all towns over 95 per cent. have.

Mr. Blyler's paper should be read by every commercial gas man. I would recommend that a committee be appointed to look over and call to the attention of the Association all literature written in the last few years that tends to the development of gas sales, and that they collect all the different schemes of advertising and put them in good shape for distribution to our members.

Rapid Purifier Cover Fasteners.[1]

By Mr. R. J. Milbourne.

Every gas manager of experience knows the difficulties connected with the holding down of purifier covers on luteless boxes; but for years engineers have continued to design and build purifiers without making in this important detail of construction any radical departure from the somewhat antiquated screw bolt and nut. Great attention has been devoted to novelties in girds, new methods of discharging the lime or oxide, economical construction of lifting apparatus, special valves, new joints, etc. A good deal of time and consideration has been spent on endeavoring to calculate and deal with the strains set up in purifiers and covers, which have led to various alterations in their design—benefiting the gas companies, inasmuch as they mean reduced weight, and in consequence less cost. Naturally, in large purifiers, such as are necessary in works of considerable size, a scientific construction on all points is compulsory; but at the same time, perhaps too little attention has been paid to what may be called "minor matters of detail," such as fasteners. Probably use has a good deal to do with this. One gets accustomed to a certain class of article, and (use being second nature) the certain article becomes, as it were, standardized, and the various inconveniences arising from its use are not always noticed. Then, when attention is called to a new thing, one begins to wonder how the old-fashioned affair could have been tolerated so long.

However, leaving this out of the question, the fact remains that the fastenings of purifier covers do not appear to have occupied the thoughts of the inventive mind until several years after the introduction of luteless purifiers; and the motto "I will serve" seemed to suffice for any arrangement of cotters, screwbolts, or other appliances, so long as it did not give too much trouble. No doubt the gas engineer and manager was occupied with something more important, and the details of fasteners which came forth with the first design of luteless purifier would be good enough for him. In connection with luted purifiers, some very primitive examples might be mentioned. The writer remembers seeing in his early days, at a gas works which shall be nameless, a set of purifiers 14 feet square, where the wrought iron covers were held in position by 4 timber struts formed out of 9-inch by 3-inch planks placed between the top of the cover and the tie-beam of the roof trusses. In another instance, the wrought iron covers were secured to the cast iron box by means of pieces of 1-inch gas tubing, laid across the corners of each cover, and passing through long eye bolts, the lower ends of which were held to one of the vertical flanges by the simple method of a bolt (without a nut) stuck through one of the ordinary bolt holes of the vertical flange in the cast iron box—the original bolt having been removed for the purpose. This, perhaps, was not a bad arrangement, because, owing to the amount of play between the tube and the eye-bolt, the purifier cover when in use performed a "wobbly" kind of dance, which showed clearly that the purifier was "working." When it was required to empty the purifier, the pieces of iron pipe were taken out and thrown on the ground, where they were always ready when wanted.

With the old style of luted purifiers, having a ponderous steel cover, there was no necessity for fasteners to be fixed nearer than 5 or 6 feet apart, or even more, unless the purifiers had deep lutes capable of allowing considerable pressure to come on the cover. Any improvement on the usual type of staple and double cotters, designed so as to obtain a level bearing top and bottom, was then unnecessary. But with the advent of purifiers having luteless lids, requiring fasteners much closer together, the question of an improved arrangement had, in the natural course of events, to be dealt with. The ordinary hinged bolt and nut is no doubt the form of fastener most universally adopted, owing to its extreme simplicity and small first cost. This simple form of fastener has still many able advocates, who argue that it is so rarely that a purifier cover has to be lifted, that it is unnecessary to provide any more expensive form of fastener. While this might be admitted as applicable to small or medium sized gas works, yet, in the case of large purifiers worked constantly, the eye-bolt fastener is at once objectionable and tedious to manipulate, owing to the number of bolts lying on the decking, with their liability to rapid corrosion from oxide and damage in other ways. Furthermore, there are many gas works not provided with sufficient purifying area; and the manager is therefore obliged to change his purifiers frequently, and is unable to keep a box out of use. In all such works, it certainly must be a distinct advantage to put a clean purifier into action with as little delay as possible; and the men required to screw up the holding down bolts could no doubt be employed on some more profitable work. When we consider that on a purifier (say) 30 feet by 20 feet, there will probably be about 90 bolts which require to be separately adjusted, it will be seen that some considerable time must be lost in the complete operation of fastening or unfastening the cover. To secure the covers for this purifier would take about 40 minutes, as it is practically impossible with bolt fasteners to make a tight joint between the rubber pad and the top of the purifier with bolts at more than about 2 feet centers; and when the cover is being fastened, the bolts must be gone over 2 or 3 times to secure equal pressure at all parts of the curb and prevent any escape of gas. However, these little inconveniences have been endured; but propably not without silent grumbling from the men who have had to operate the fasteners. Take the system of cotters and staples. This form of fasteners is occasionally applied to covers of the luteless type, probably with the idea that it can be more quickly operated than a bolt. The chief objections to this type of fasteners—particularly when applied to a luteless cover—are, firstly, the uneven pressure on the top of the cotter, owing to the wedge shape; and secondly, the cotter gradually cuts a groove in the top sheeting of the cover.

Bearing all these little things in mind, it is not to be wondered at that mechanical engineers have turned their attention to the production of some improved system of fastener, which would save time and keep the top plates clear of bolts and other obstructions. An arrangement of purifier fasteners which can be operated at one motion—by which the whole of the fastenings on the cover can be actuated at once—seems to be the thing desired. The Milbourne automatic rapid fastener, manufactured by Messrs. C. & W. Walker, Limited, of Donnington, accomplishes this; and though it is specially designed for luteless purifiers, it can, if desired, also be adopted for purifiers with water lutes. As there are now over 2,000 of these fasteners in operation, a brief description of them will no doubt prove acceptable to those gas engineers and managers who hardly feel content to adopt bolts or cotters for fastening a modern purifier cover. The Milbourne fastener enables the complete cover to be fastened and unfastened on all sides, by one man, in less time than it would take to screw or unscrew even one of the many bolts and nuts attached to the cover in the ordinary way; and considering that a 10-foot square cover would hardly be made tight with less than 24 bolts, the saving in time and labor becomes apparent.

1. *Journal of Gas Lighting.*

The fastener consists of a number of clutches mounted on a square steel shaft, running along each edge of the cover; the shafts being connected at the four corners by cast steel miter gearing. The shafts are mounted on very simple bearings, and by means of eccentric disks actuate the fastener clutches, which are spaced at about 3 feet centers; these wider centers (as compared with bolts) being made possible by the better distribution of pressure on the cover curb. The opening or closing of the cover is effected on all the four sides simultaneously by one action of a hand lever, moving through an angle of 120°. In fastening down a cover, the first portion of the stroke of the lever brings the holding down clutches into position immediately underneath the cast iron flange of the purifier fender plate or curb round the opening; while the remainder of the stroke imparts an upward vertical motion to the fastener clutch, which firmly grips the curbs of the purifier and cover together, thus compressing the indiarubber pad and making a perfectly sound and gas tight joint. By reversing the motion of the lever, the holding down clutches are released, lowered vertically, and then slightly rotated to such a position that they clear all flanges, thus allowing the cover to be freely raised and travelled away.

With this form of fastener, the cast iron covering or decking of the purifier is kept quite clear of all bolts and other obstructions whatever after the cover is raised, as all the clutches are permanently fixed to the angle curb of the cover. The clutches give a much greater and more even bearing than ordinary holding down bolts, or any other type of fastener. The covers have been designed to resist the internal gas pressure without causing any undue strain to come upon the top sheeting, or the rivets attaching them to the top curb. The fastener requires practically no preparation in the cast iron purifier itself; all the fastening apparatus being contained on the cover and raised with the cover. It is therefore entirely out of the way during the process of filling or emptying the box; offering no obstruction whatever to the operation of the workman while discharging the lime or oxide from the purifier. The cost of an installation of fasteners, taking the set of purifiers throughout, would, of course, be more than the ordinary bolt or cotter fasteners; but this extra expense should very soon be recovered in the saving of time and inconvenience, and the decreased maintenance charges.

Fig. 1 shows a side elevation of the clutch in position; the outward movement of the combined lever having pressed the rubber, and thus effectually made a tight joint between the angle curb of the cover and the cast iron fender of the purifier. Fig. 2 shows the clutch in what

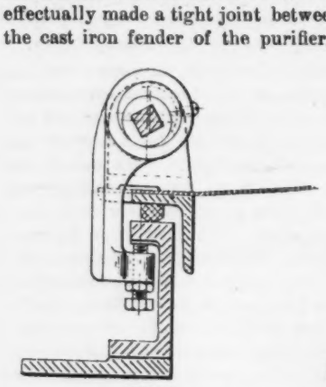


Fig. 1.

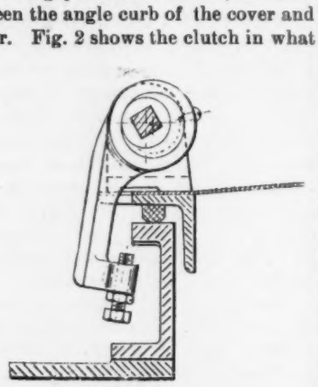


Fig. 2.

may be termed its "second position," partly released and on its way to be thrown back on to the top of the cover, as illustrated in Fig. 3 in which final position it remains while the cover is raised, travelled and lowered. When the cover is to be again replaced, the reverse motion of the lever will raise the whole of the clutches from the top of the cover and again carry them into the vertical position; the tightening up being effected by the completion of the lever movement. Fig. 4 is an end elevation of the miter-gearing adopted to insure the unification of movement throughout the whole of the clutches.

By simply turning the operating lever and making it describe the half circle, the fastener is thrown into operation; and by one motion of the lever the whole of the fasteners on all four sides of the purifier cover are brought into their proper position and secure the cover to the purifier on all four sides at the same time, without any danger of unduly straining the purifier or the cover angle curb. It will thus be seen that, by one operation, the whole of the fasteners are actuated as though they were one fastener: and it is, therefore, quite clear that a purifier cover fitted with this apparatus could be fastened or unfastened in one-twentieth of the time that one could be fastened in the usual way. According to the number of ordinary bolt fasteners used on the cover—

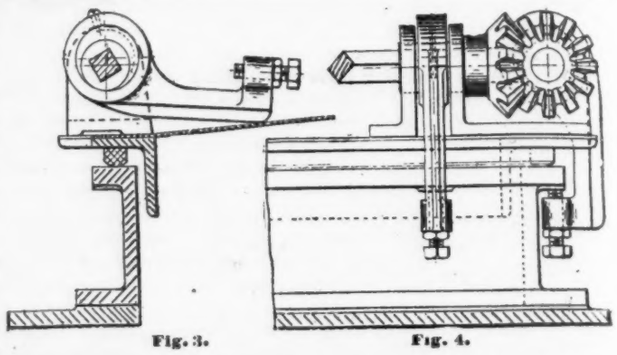


Fig. 3.

Fig. 4.

whether 10, 20 or 30 of them—this apparatus would do the work in one-tenth, one-twentieth or one-thirtieth of the time. With the Milbourne rapid fastener there are no cotters to fix in position; the whole of the clutches act automatically. The cast iron flanges of the purifiers are kept quite clear of all bolts or any obstruction whatever after the cover is raised, thus enabling the gangway down the center of the purifiers to form a path for a travelling jib-crane if desired. The clutches also give a much more even bearing. With the bolts, the whole of the pressure is exerted on a very small area, which necessitates the bolts being placed from 1 foot 8 inches to 2 foot centers, or the curb being made unnecessarily strong, to prevent being bulged up between the bolts and causing leakage.

The writer hopes that these remarks may be worthy of consideration from gas engineers who have purifier extensions in contemplation, and are not disposed to follow the already beaten track of bolt-and-cotter fasteners.

Purification of the Effluent of Sulphate Plants.—A New Process.

How to get rid of the effluent and "devil liquor" of a sulphate of ammonia plant without causing offence is a problem that many gas works have to face from time to time, and it has been a problem of such magnitude in many cases that rather than face it not a few gas works have abandoned the idea of converting their ammoniacal liquor into sulphate of ammonia. But the problem seems now to have been solved, and in a very simple and inexpensive way. A representative of *The Gas World* was given an opportunity of seeing the new process at work at a certain gas works last month, and the fact that several gas engineers have already been to the same town to examine the process confirms the favorable opinion formed of it. We are not at liberty to mention the gas works in question just at present, but the purification process there in operation is due to Mr. John Radcliffe, of East Barnet, Herts., and the results obtained at this gas works, where the process was first tried on the working scale, have been so satisfactory that at least one other works, somewhat similarly situated, is now busy installing the new plant.

Apart from its simplicity and the small amount of attendance required, the compactness of the plant is especially noteworthy. At the works referred to the maximum day's output of gas is about 800,000 cubic feet, and the whole plant for dealing with the effluent from the sulphate house does not cover an area of more than 12 by 8 yards; and a good deal of this space would be required in any case. Indeed, in the instance under notice the extra space occupied by the introduction of the new process does not exceed 9 by 2 yards.

The Process Described.—The process of purification consists in first acidifying the effluent and then precipitating the sulphocyanogen compounds therein by means of a solution of sulphate of copper. The acidification is affected by drawing a portion of the sulphuretted hydrogen from the sulphate plant and burning it over a coke fire in a small kiln. The resulting sulphurous acid is passed into a brick chamber filled with chequer brickwork over which a stream of water is run, washing out most of the sulphurous acid. The gases pass from this chamber to a wooden chamber adjoining, in which there are a number of layers of limestone, and over which water also trickles. The outlets from both these chambers are directed into an open sunk tank, to which the effluent from the sulphate house is taken. The flow of the effluent into this tank is so arranged that the acid liquor from the two chambers referred to first comes into contact with the effluent, and then a steady stream of solution of sulphate of copper is added, with the result that an immediate precipitation of the deleterious substances in the effluent

takes place. The liquor next flows through two small settling tanks, then through an open cooling tank fitted with tortuous channels, and finally through two small breeze filter beds. The change in the appearance of the effluent is immediate upon the addition of the sulphate of copper solution, and by the time the liquid has reached the cooling tank it is perfectly clear, the breeze filter beds being merely in the nature of an extra precaution against any solid matter going forward. The effluent so treated can, we are informed, be passed through the bacteria beds of any sewage system without having any deleterious effect upon them: and personal observation shows that the purification process can be carried out on a gas works without causing any nuisance whatever. Indeed, the absence of smell, both in the sulphate house and at the effluent purification plant, is very remarkable.

The solution of sulphate of copper is prepared in two small tanks, used alternately. While one is being prepared the other is at work; and they are so connected that one or the other can be brought into use by the manipulation of two taps. A steady head upon the delivery into the precipitation tank is obtained by means of a small feed cistern common to both tanks, and the flow into this is controlled by a ball valve. Simple and effective means are provided for ensuring that correct mixtures are made and remain so continuously. In fact, all the active attention required for the plant is to see that the coke fire is kept up in the kiln and to prepare the sulphate of copper solution. From time to time, too, the precipitate of copper and sulphocyanide compounds is pumped from the precipitation tank into a drying press. Here the surplus water is squeezed out, and the sludge is then transferred to barrels for delivery to whomsoever will buy.

Commercial Considerations.—And here comes in the important question, Will the process pay? We believe the inventor does not yet claim that it will pay in the sense that a product can be produced that will cover the cost of the purification in works of the size mentioned. But if it will convert a liquor that has hitherto been a nuisance, and in many cases a prohibited nuisance, there can be no doubt that it will pay indirectly. At the same time there are good grounds for thinking that it will yet be found to pay directly, even in small works. So far the experience of the works at which the process has been in operation for some time has been that there is a market for the precipitate at a price something higher than what is paid for the necessary sulphate of copper, and, as has been indicated, the other costs must be exceedingly modest.

As an indication of the quantity of copper sulphocyanide sludge that might be put on the market by the process, it may be said that in the production of 70 tons of sulphate 5 tons of copper sulphate were used in purifying the effluent and 6 tons of sludge were produced.

The Mechanics of Luminosity.[1]

Some Continental critics have been rather inclined to ridicule a certain practice, almost confined to the British school of scientific thought, that is to say, the practice of picturing a mechanism capable of reproducing the phenomena of molecular physics, and of reasoning about this arbitrary concept, instead of confining themselves to a mere study of certain differential equations. Such critics have, it is true, been to a large extent silenced by Helmholtz's confession that the method had led to remarkable results in the way of the advance of discovery, and it has, moreover, the further advantage of permitting a plain man, ignorant of higher mathematics, to obtain some idea as to the nature of the phenomena in question.

Professor J. J. Thomson, perhaps the leading living physicist, possesses this characteristic of the British school of science in a marked degree; and for this reason his Friday evening lectures at the Royal Institution are of especial interest to those who, though incapable of following in their entirety the remarkable series of researches by which the Cavendish Laboratory at Cambriuge has become a sort of Mecca for the student of physics, are nevertheless anxious to gather some gleanings from the fruits of those important investigations. Nothing could better serve this end than the highly suggestive lecture on "Some Applications of the Theory of Electric Discharge to Spectroscopy," delivered last month at the Royal Institution by Professor Thomson. In opening his discourse he stated that when an electric current passed through a gas, the color of the light and the character of the spectrum depended not only on the chemical nature of the gas, but also on the nature of the current, the spectrum being often entirely different with an arc discharge from what it was with a spark discharge. Moreover, in certain cases the color of the spectrum was entirely different in different parts of one and the same tube. This was shown by Professor Thomson with a Plucker tube containing air, the peculiarity of the tube being that it consisted of two wider portions connected by a capillary channel. The color of the glowing gas in this narrow channel was entirely different from its color in the bulbs. Recent investigations, he proclaimed, had thrown a good deal of light on what actually took place when a gas became luminous by the passage of a discharge, and he intended that evening to explain in what manner the different effects observed were accounted for by theory, and a comparison of the difference in the nature of the luminosity produced with different voltages threw, moreover, a good deal of light on the generation of spectra. These researches had, he remarked, been much facilitated by the observation that when lime or barium oxide was used as the cathode an extraordinary number of negative corpuscles were emitted at all temperatures of the cathode. Thus, using lime, a P.D. of only 18 to 100 volts would give a very bright discharge, and alterations of the current strength and potential difference with a very wide range were thus much easier to make than with other substances as cathode. The apparatus used was that shown in Fig. 1. The lime here was deposited on a thin platinum wire carried by stout leads, as shown. An independent current passing through these leads served to keep the platinum wire red hot, whilst a third wire led from the center of the cathode thus formed to the negative terminal. A bulb of this kind could also, he stated, be used as a rectifier, since the current would only pass through the tube when the lime was the cathode. The discarge in the tube shown by Professor Thomson was blue, and was very sensitive to the action of a magnet, which not only deflected the moving particles, but concentrated them along the line of force.

A peculiarity of the discharge, he pointed out, was the abruptness with which luminosity made its appearance. In the laboratory a difference of $\frac{1}{100}$ volt was sufficient to cause the tube to pass from perfect darkness to quite a bright discharge. The light therefore made its appearance instantly, and did not start as a faint glow, and gradually get brighter. This fact, he considered, was most important in the mechanics of luminosity, and the conclusion he had come to was that owing to the bombardment of the atoms of the residual gas by the flying corpuscles, the internal energy of the atoms was increased. This increase of energy required time for it to be radiated off, and if the impacts followed each other sufficiently rapidly, the value of the internal energy was raised to a critical value at which the equilibrium became unstable, when the atom itself flung off a corpuscle, and the shock of the discharge threw the rest of the atom into vibration, giving rise to light, which, therefore, was the direct consequence of atomic instability.

In confirmation of this it was found that the negative corpuscles emitted when Röntgen rays fell on a metal had the same penetrative power, whatever the intensity of the Röntgen rays, whereas were they dragged out of the atom by the electric field of the rays, their speed and penetrative power should increase with the strength of the radiation. This was not the case, since an increase in the strength of the Röntgen rays merely increased the number of corpuscles liberated, and not their penetrative power. Lenard had further shown that the corpuscles expelled on letting ultra-violet light fall on metals had a velocity quite independent of the intensity of the light, which is what would be expected were the instability set up in the atom the real cause of the expulsion, whilst the rays or ultra-violet light merely served as a sort of trigger.

When a corpuscle struck an atom in a vacuum tube, the internal energy of this atom was increased, and might, as stated, accumulate to a critical value. As soon as the gas became luminous there was an enormous increase in the current, a difference of $\frac{1}{100}$ of a volt sometimes causing a 60 fold increase in the current. The stage at which luminosity set in depended much on the temperature, the luminous point being reached with, say, 55 volts at high temperatures and 100 volts at low. An increase in the current density, moreover, tended to promote the luminous discharge, since each atom encountered more corpuscles in a given time. A single collision was insufficient to render an atom luminous. There must be many. Hence, as the action of a magnet tended to concentrate the discharge, a tube would become luminous at a lower P. D. when a magnet was held near it than when the magnet was absent. If single collisions sufficed to render an atom luminous, the intensity of the light should increase proportionately to the current; but this was not the case, the increase of luminosity being much more rapid than the increase in the number of cathode particles.

Hence, to get luminosity, we must, Professor Thomson said, be able to raise the internal energy of the atom to a certain critical value, and the atom must not part with the energy thus received too rapidly, or

1. *Engineering*, London.

this critical value would never be reached. Calling the rate at which the atom received energy a, and assuming that the rate at which it radiated off energy was proportional to its total internal energy, the rate at which this energy increased with lapse of time was given by the expression

$$\frac{dE}{dt} = a - \beta E;$$

and the total internal energy at any time was thus

$$E = \frac{a}{\beta}(1 - e^{-\beta t}).$$

The maximum value which E could reach after the lapse of infinite time was $\frac{a}{\beta}$. Typical curves showing E were represented in Figs. 2 and 3.

It appeared, Professor Thomson continued, that there were two radiating systems in an atom. One of these was a poor absorber of energy from the corpuscles, and also a poor radiator, whilst the second was both a good absorber and a good radiator, so that the faction $\frac{a}{\beta}$ for this second system was less than for the first. For either system to give light a certain critical value of E must be attained, which for simplicity might be taken as the same for both systems.

Suppose, then, that in Fig. 2 the rate at which energy is supplied was small, but the supply was long continued, and let also the dotted line represent the critical value for E at which luminosity appeared; then the upper curve represented the case of the poor absorber and poor radiator, which would, as represented, ultimately exceed this critical value, whilst the good radiator and good absorber represented by the other curve would not reach it. If, however, the rate at which energy was supplied were increased, then we obtained the condition of affairs represented in Fig. 3, where both curves exceeded the critical value, and the good radiator did so first. If, moreover, the supply of energy ceased soon after this latter event, it would be seen that the poor radiator and absorber would not have time to reach the critical state, so that the spectrum corresponding to the second vibrating system would alone be seen.

As an illustration, Professor Thomson suggested that E should be taken to represent a man's capital and a his income, and that the amount he spent was a constant fraction of E. Then the poor absorber and radiator corresponded to a man receiving a small salary, but also spending little—say, at the rate of $\frac{1}{10}$ of his total capital existing at any time. If his salary were £1,000 per annum, and a capital of £20,000 would make him a "shining light," he would if his salary lasted long enough, reach this limit, and, if he lived an infinite time might accumulate £30,000. If, on the other hand, a man's salary was £5,000 per annum, and he spent at the rate of $\frac{1}{4}$ of his capital, he could never, no matter how long he lived, accumulate more than £15,000, and hence would fail to reach the position of a "shining light." Suppose, however, that times changed, and the salaries became four times as great, but lasted a much less time; then the second man would attain the desired standard very quickly, whilst, if the good times were sufficiently short, the other might never reach it at all.

In these considerations was, he thought, to be found a clue to the passage from arc to spark spectra, and also of the influence on spectra of inductance and capacity. With the arc discharge one got a large, steady current, the average value of which was practically the same as the maximum. With the spark discharge the average value of the current was small, but the maximum value, though it lasted for only a short time, might be very great. Returning to the analogy just given the saving man was favored by the arc, and the man with large earnings and large expenditure by the spark discharge. Again, where the discharge passed through a capillary tube the current density was great and therefore the internal energy of an atom encountered might be increased by the numerous impacts, so that the second system was put into vibration; whilst in the wider parts of the tube only the first system alone reached this critical stage. The spectrum of the discharge in the two portions would thus be different.

Similar considerations applied to the alteration produced in spectra by varying the capacity and inductance in the spark circuit. An increase in capacity increased the maximum rate at which work was done in the circuit, whilst self-induction had a precisely contrary effect, so that with a large inductance the discharge approximated to the arc type. This was well shown by vacuum tubes containing argon, which, as discovered by Sir William Crookes, gave a light of an entirely different color, according to the relative inductance and capacity of the spark circuit in which they were included. Professor Thomson showed that when such a tube was connected up to a spark circuit of large capacity, but small inductance, it glowed with a red light, whilst the addition of a large inductance to the circuit caused the color of the discharge to alter to a bright blue; similarly, a neon tube glowed yellow when the inductance in the circuit was small, and green when it was large. To illustrate the kind of action which was held to be responsible for this change, the lecturer exhibited the piece of apparatus shown diagrammatically in Fig. 4.

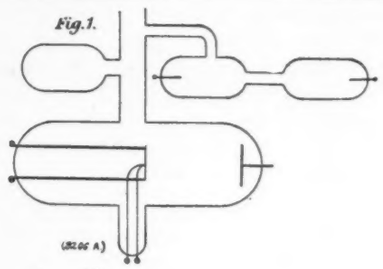
Hence, a red and blue lamp were arranged in parallel on the same source of supply. The red lamp branch has a large inductance and a low resistance, whilst the blue lamp formed part of a circuit of high resistance and low inductance. Connecting the device with a source of continuous current, the red lamp alone lit up; but on an alternating circuit this remained dark, and the blue lamp was the one which glowed.

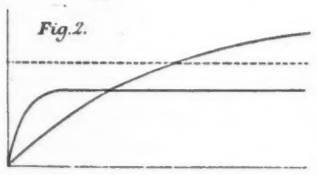
On these lines he thought it was possible to account for the double spectrum of argon without assuming any decomposition of the atom of the gas. Both of the vibrating systems postulated were interior to the atom, and either one or the other would be set in vibration according to the character of the discharge. It would, he continued, be of great interest to watch the behavior of the gas whilst the inductance was slowly increased, and to note whether the change of spectrum took place gradually, the new one making its appearance line by line; or whether all the lines of the new spectrum appeared simultaneously. Some experiments by Professor Wood had a bearing on this. In these the luminosity of sodium vapor was excited by means of light, and the color of the spectrum was found to depend on the wave length of the incident light. With a certain wave length a spectrum containing certain lines was observed. Altering the wave length of this incident light, the spectrum disappeared entirely, until by continuing the alteration an entirely different spectrum suddenly made its appearance, the whole of the lines of which appeared simultaneously. On the hypothesis made this was to be expected. Either vibrating system, when it reached the critical point, taking simultaneously all its possible modes of vibration.

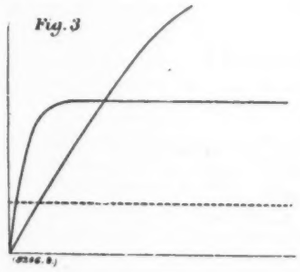
It should further be noted that the rate at which the atom received energy by impact depended also on the nature of the projectiles as well as on their kinetic energy. If these were moving corpuscles, there would also be a particular speed at which the amount of energy transferred to the vibrating system was a maximum. The quicker the natural period of this system the higher was the speed at which the corpuscle must move for the maximum transference of energy to take place. The speed of the corpuscles was dependent on the pressure in the tube, being highest when this pressure was low, so that a change of pressure might give rise to a change of spectrum.

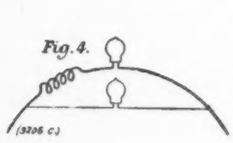
Further, if, instead of bombarding the atom with corpuscles, the projectiles were bodies of atomic dimensions, the spectrum produced was very different. For this purpose the lecturer made use of the apparatus represented in Fig. 5, where there is shown a metallic plug pierced in the center, and which by means of the connecting wire shown could be made, at will, either an anode or a cathode. When the latter, the return flow of positive particles of atomic dimension passed down through the plug and incited the luminosity of a layer of lithium salts deposited on the inclined plate shown, which then gave a red light. If, however, the upper terminal were made the cathode, the much smaller negative particles would strike the lithium salt, and the color of the fluorescence was then bluish green. He did not know, he said, whether any effect would be produced if metallic lithium were substituted for the salts of that metal, but a similar bombardment of metallic sodium did not give rise to the spectrum of that metal, while that of its salts did. If the discharge were directed on to a layer of sodium potassium amalgam, any small particles of oxide on the surface would glow with a yellow light, while the clean metallic surface remained dark.

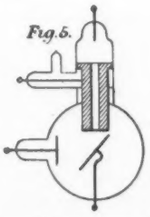
Summing up, on the theory set forth, luminosity was due to a critical state of the internal energy of an atom. Temperature, on the other hand, measured the energy of translation of an atom, yet a certain equilibrium must exist between this energy of translation and the internal energy; and by sufficiently increasing the energy of translation, sufficient of this might be transformed into internal energy to give rise to luminosity. The advantage of exciting luminosity by the electric method was that the energy was added, in the first place, direct to the internal energy of the atom, and equilibrium of this and the energy of translation was established by the transformation of part of this internal energy. The difference between this and the ordinary method of exciting luminosity by the raising of the temperature, the speaker compared to that between boiling a kettle by lighting a fire under it, and doing the same thing by setting the kitchen on fire.











In conclusion, Professor Thomson showed an experiment with a tube containing a calcium electrode, which he considered threw much light on the nature of the arc. The discharge of such a tube increased as the temperature of the cathode was raised. If this discharge was sufficient, the temperature was still further augmented by the impact of the positive particles from the anode, and the temperature being thus automatically increased, the discharge finally reached a point where it formed a veritable arc.

Refractories and Firebrick.

In a paper read by Mr. William A. Stanton, New York, representing the Harbison-Walker Refractories Company, Pittsburgh, on "Refractories and Firebrick," at a meeting of the Niagara Frontier Purchasing Agents' Association, held at the Lafayette Hotel, Buffalo, January 18, the speaker said:

In the manufacture of the highest grades of fire claybrick about 14 processes or handlings are necessary before the bricks are on cars ready for shipment. In the manufacture of 1,000 bricks about 4 tons of raw clay and approximately 1 ton of coal are required in the various processes of drying and burning. The best fireclay bricks are hand made, and there is always a considerable amount of breakage on the floors and kilns, so that we might say, approximately, 5 tons of material are used in the manufacture and about ½ a ton is culled out before 1,000 properly selected uniform clay bricks can be shipped.

The limit of refractoriness for the highest grade of fire claybrick could be put at about 3,350° F. There are only one or two brands that could stand this, and a temperature as high as this would be too much for regular work; probably 3,000 to 3,100° is the highest working temperature the best fireclay brick would stand.

In studying the conditions under which fireclay bricks are used, it had been found absolutely necessary to vary the grind, mix and burn in order to meet these conditions and insure the bricks for a certain purpose are uniform. Uniformity, next to quality, is the most essential requirement in fire claybrick. Variations of mix, grind and burn enable the manufacturer to select brick for blast furnaces that in the hearth and bosh of the furnaces will be able to withstand the high temperatures as well as the action of the molten slag, iron, etc. In the inwall the temperatures are not so high as around the tuyeres, but the pasty condition of the stock and its ability to stick and tear out the brick, as well as the chemical action of reduction, require that the lining at this point shall be adapted to meet these conditions; while in the upper portion of the furnace the large volume of reducing gases under pressure, the abrasion of the stock falling from the bell and the bombardment with gases loaded with fine particles of coke, ore, etc., which constitute a sand blasting action, all demand that the utmost care and experience be given to the lining at this part of the furnace if it is expected to stand any reasonable length of time.

When we come to brick for hot blast stoves we have severe conditions prevailing in the combustion chamber which demand a brick of the highest refractoriness; this is also the case in the dome and the upper portion of the stove. In the checkerwork the passage of gases of high temperatures, loaded with fine dust, demands that the bricks should be refractory, strong, should not scale or dust and be of good workmanship in order that they may fit closely, and thus avoid, as much as possible, the tremendous movement in the stove due to the variation of temperature caused by turning in cold air on hot brickwork. The girder tile and checkerwork in the lower portion of the stove have to withstand movement and weight amounting to several hundred tons of superimposed brickwork. All this demands the best care and attention of the manufacture to insure long life. Two or three years ago in Pittsburgh one of the large iron manufacturing companies had the experience of practically the whole of its stove brick falling to pieces. The bond of the brick was destroyed by the action of the gases and grinding action of the stove, and the material was shoveled out in the form of small pieces and dust. This was after a run of only 8 or 10 months. The bricks for piping, down comers, valve openings, etc., all have to be made to withstand the variation of temperature and the sprawling action due to the frequent openings and rush of cold air on to the hot brickwork.

Brick for mill furnaces has to meet very different conditions from those prevailing in blast furnaces. The intense heats of heating furnaces and soaking pits demand a brick not only of the highest quality as to its capacity to resist heat, but a brick that shall not spawl or flake when subjected to variations of temperature, and the manufacturer is obliged to vary his methods of manufacture in order to meet these conditions. Other purposes for which fireclay brick is used, such as malleable furnaces, air furnaces, boiler settings, stokers, copper furnaces, crucible furnaces, cupolas, metal mixers, cement kilns, etc., all have conditions peculiar to themselves, and all demand most careful consideration before the brick can be manufactured to give the most economical results.

The laying of brick is a very important matter, as is also the clay used in the laying. This clay should always be of the same composition as the brick laid with it. The smallest possible amont of clay should be used in the joints. Thick joints and poor clay have caused more wasted brick and more expense than almost anything else that could be mentioned. The vital importance of slow and thorough drying out in all construction work, such as blast furnaces and stoves, is seldom appreciated. Steam is fatal to the bond of brick, and when we remember that some of the walls of blast furnaces contain as much as 5 or 6 feet of lining, almost, in a straight cylinder 80 to 100 feet high, it is impossible to believe that the moisture can be driven out of the walls in any such short period of time as some blast furnace managers now give to the blowing in of furnaces. There is no question that some of the recent failures of linings have been due to rapid blowing in, and while the natural anxiety of blast furnace managers to make iron in these times is understood, it does not appear reasonable to blame the brick when it is known that the furnaceman took only about one-sixth of the time necessary to dry out such a mass of brickwork.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

A CORRESPONDENT in Quincy, Ills., informs us that Mr. W. A. Bixby, Manager of the Quincy Gas and Electric Company, has resigned that position to accept the direction of the Western gas, electric and street railway properties controlled in that territory by the Portland (Me.) syndicate. Mr. Bixby's act becomes effective the 1st prox.

MR. F. C. SHERMAN and wife, accompanied by their son, Mr. C. D. Sherman, are to be away from New Haven, Conn., that will keep them from visiting Savin Rock for 3 months from the 3d inst. On that date the party sailed for a trip along the Mediterranean shores and shoals.

MR. THOMAS D. MILLER, General Manager of the New Orleans (La.) Lighting Company, has been authorized to publish the following notice: "The New Orleans Lighting Company announces a reduction in the net price of gas of 5 cents per 1,000 cubic feet on all gas consumed after the January reading. For payment at the office on or before the 10th of the succeeding month the discount will be 20 cents instead of 15 cents per 1,000 cubic feet as heretofore, making the net price of gas in New Orleans $1.20 per 1,000 cubic feet."

"AT the annual meeting of the shareholders in the Willimantic (Conn.) Gas and Electric Light Company the Directors chosen were: George A. Lewis and D. Tilley, of Boston; C. H. Evans, of Chicago, and J. F. Church and C. W. Noyes, of Willimantic. The latter succeeds Mr. Emerson Stone, of Spencer, Mass., who died last summer.—R. W."

THE Newport News (Va.) Gas Company has elected the following officers: Directors, W. J. Payne, Samuel Regester, E. M. Braxton, George A. Schenly, V. B. Barclay, J. M. Curtis and H. H. Carr; President, W. J. Payne; Vice-President, J. M. Curtis; Secretary, J. H. Dalton; Treasurer, Franz von Schilling; Superintendent, V. B. Barclay.

IT is not at all unlikely that the gas and electric plants in Bucyrus, O., will be acquired by the authorities for operation on municipal account.

THE following proposed act is now before the Rhode Island Legislature—it was introduced by "Mr. F. X. Leonidas Rattey," of Central Falls, and its provisions look to be as reasonable as are the words of his name:

"It is enacted by the General Assembly as follows:

"Sec. 1. The illuminating gas of every company dealing in illuminating gas in every city and town in this State, containing a population of 10,000 or more people, shall be inspected at least twice a year, and may be inspected as frequently as the superintendent of street lights, in such city or town where there is such an official, and in such city or town where there is no such official, as the person for this purpose selected by the town or city council of such town or city may think best, but not more often than once a week. The gas shall be tested for illuminating power by means of the disk photometer, or other improved apparatus, and during such test shall be burned from a burner best adapted to it, which is at the same time suitable for domestic use, and at as near the rate of 5 feet per hour as practicable. The gas shall be tested as to its safety to public health in such a manner as the said person authorized to conduct such inspection may direct.

"When the gas of any such company shall be found on 3 consecutive inspections to be of an illuminating power less than (20) sperm candles of 6 to the pound, and burning at the rate of 120 grains of spermaceti per hour, at such place as the person authorized to inspect shall specify by the burner consuming 5 cubic feet of gas per hour, and shall not comply with the reasonable and proper standard of purity and standard of safety to public health as fixed by said person as is authorized to conduct such inspection, a fine of $100 shall be paid by such company to such town or city.

"Sec. 2. This Act shall take effect immediately."

THE many gas men, of the real type or otherwise, who have had occasion to visit the plant of the Easton (Pa.) Gas Light Company, will regret to know that "Spot" is no more.

THE Gas Machinery Company, of Cleveland, O., has been awarded a contract for the construction of a new coal gas plant for the Jackson (Miss.) Electric Railway, Light and Power Company.

AT the annual meeting of the Key City Gas Company, of Dubuque, Ia., no change was made in the executive management. The annual report showed an increase in output amounting to 25 per cent. over that for 1904. The Company has 47 miles of mains in use, and it is planned to largely increase the same this year.

THE handsome, commodious new office quarters of the New London (Conn.) Gas and Electric Company, which are located in the Crocker House Annex, Union street, that city, were formally opened last Monday with all "the belongings" that go on such occasions. The New London *Day*, in an account of the "opening" incidentally remarked, "To say that this is the finest office in the city is merely stating fact."

MR. E. M. OSBORNE has been appointed Manager of the Holland City (Mich.) Gas Company, vice Mr. C. W. Fair. Mr. Osborne was formerly in charge of the Xenia (O.) Company.

AT the annual meeting of the Stamford (Conn.) Gas and Electric Company, the officers elected were: President, Walton Ferguson; Vice-President, Samuel Fessenden; Treasurer, Alfred W. Dates; Assistant Treasurer and Secretary, Chas. H. Lounsbury.

ARTICLES announcing the incorporation of the Brandywine Gas and Electric Company, of Wilmington, Del., have been filed. It is capitalized in $100,000.

THE proprietors of the Citizens Gas Company, of Quincy, Mass., have officially proclaimed that the reduced selling rate ($1.50 per 1,000 cubic feet) will become effective July 1st.

THE regular quarterly dividend of 2 per cent. on the shares of the Brooklyn (N. Y.) Union Gas Company is payable the 1st prox. The books were closed last Saturday.

THE Minneapolis (Minn.) Gas Light Company has arranged for important betterments on its plant. In the scheme is included the construction of a gasholder up to retaining 2,500,000 cubic feet, and our informant further states that the generating capacity is to be at least doubled.

ARTICLES declaring the formation of the Hampton-Phoebus and Old Point Gas Company, of Hampton, Va., have been filed. It is capitalized in $100,000, and its officers are: President, H R. Booker; Secretary, Frank W. Shield; Treasurer, B. F. Batchelor. The two first named are residents of Hampton, and the Treasurer is a resident of Norfolk, Va.

THE semi-annual statement of the Indianapolis (Ind.) Gas Company, as sworn to by Secretary Pray, in the returns to the city authorities, shows that the Company is increasing its output in great percentage—the output for the last half of 1905 was 339,065,000 cubic feet. The meters in use December 31, 1905, numbered 22,941.

THE following interesting mention of the Brooklyn (N. Y.) Union Gas Company is from the Brooklyn *Daily Eagle:* "The Brooklyn Union Gas Company, the second largest corporation in the borough, and one that serves almost as large a portion of the population as does the Brooklyn Rapid Transit Company, has had a very prosperous year. This also despite the fact that the dividend of the corporation was reduced in May from a 10 to an 8 per cent. basis, after the former rate had been in force just one year. No comparison of the earnings of the Brooklyn Union Gas Company can be made, because the Company never issues an annual report—in fact, nothing in the nature of a statement of what it is doing in the financial line is ever given to the public. A feature which helps the Company as well as the other public service corporations is the growth of the borough. The remarkable growth in building in the past 2 years, and the fact that nearly all new buildings are occupied, means increased business of no mean extent. Then, again, the use of gas for heating and cooking is rapidly coming into favor, and this also means more business. That the Company has grown with the increased population and homes in Brooklyn is shown by the fact that in 1905 there was an increase in the sales of gas of about 60,000,000 cubic feet. This means an increase in the gross earnings of the Company from this source alone of $60,000. The increase in gas sold was about 9 per cent. over last year. The Company during the year has laid 14½ miles of new gas mains, making a total of 826½ miles now covering the borough. It has also sold and connected approximately 14,000 gas cooking and heating appliances, and the number of new customers added to the books was about 17,000. During the year the Company has paid in taxes for state, real, personal and franchise, about $350,000, while no moneys have been received by it from the city for municipal lighting, street lamps and public buildings since December, 1903, and then only a small amount on account. There is now due the Company from the city about $1,250,000 without interest. New construction and replacements for increased output have been instituted in its several manufacturing plants, the daily capacity of which is now about 34,000,000 cubic feet. A large gasholder, with a capacity of 5,000,000 cubic feet, has been erected in South Brooklyn, and in use since early last fall for the better distribution of the product throughout the system. The average number of employees of the Company is 1,700—to whom are paid in salaries and wages over $1,200,000 annually."

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
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MONDAY, FEBRUARY 12, 1906.

The Market for Gas Securities.

There was a trifle of easing in the price of Consolidated since last week, the main cause for which was undoubtedly realizing on profit account by speculators. We see no reason to alter our belief that a gross rate of 90 cents will be fixed by the State Commission, the membership thereof being men of fair sense. We look for very much better prices in Consolidated.

Brooklyn Union is neglected, at 170 to 180 ex-div. Laclede common (St. Louis) might be a purchase, and Washington (D. C.) is up to 310. Peoples, of Chicago, is now on a 5 per cent. dividend basis, the quarter rate having been cut from 1¼ to 1¼ per cent. This dividend is payable the 26th inst. Baltimore Consolidated is 86 bid.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

FEBRUARY 12.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$75,177,000	100	177½	188¼
Central Union, Bonds, 5's	3,000,000	1,000	108	110
Equitable Bonds, 6's	1,000,000	1,000	..	105
" 1st Con. 5's	2,300,000	1 000	118	120
Mutual	3,500,000	100	275	290
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. .. Bonds, 5's	11,000,000	1,000	107	109
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	98	104
Northern Union, Bonds, 5's.	1,250,000	1,000	105	107
New York and East River.. Bonds 1st 5's	3,500,000	1,000	112	114
" 1st Con. 5's	1,500,000	..	106½	108½
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
Bonds, 1st Mortgage, 5's	1,500,000	1,000	111	114
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	170	180 x
" " Bonds (5's)	15 000,000	1,000	112	113
Bay State	50,000,000	50	⅝	..
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	500,000	1,000	95	100
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000.000	1.000	47½	50
Buffalo City Gas Co.	5,500,000	100	10	12
" " Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¾
Cincinnati Gas and Electric Co	29,500,000	100	105	105¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	..	95
Preferred	3,026,500	100	107½	108
Consumers, Toronto	,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	..	86½
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
For Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,325,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
" Bonds, 5's	10,500,000	..	110	110½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	86
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	.	105
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	108½	109
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1 000,004	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	100¼	100⅛
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	.
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	105¼
San Francisco, Cal.	15,800,000	100	58½	58¾
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	96¾	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	308¾	310
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600.000	50	230	..

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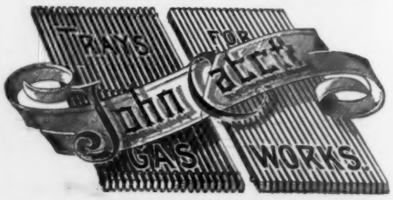

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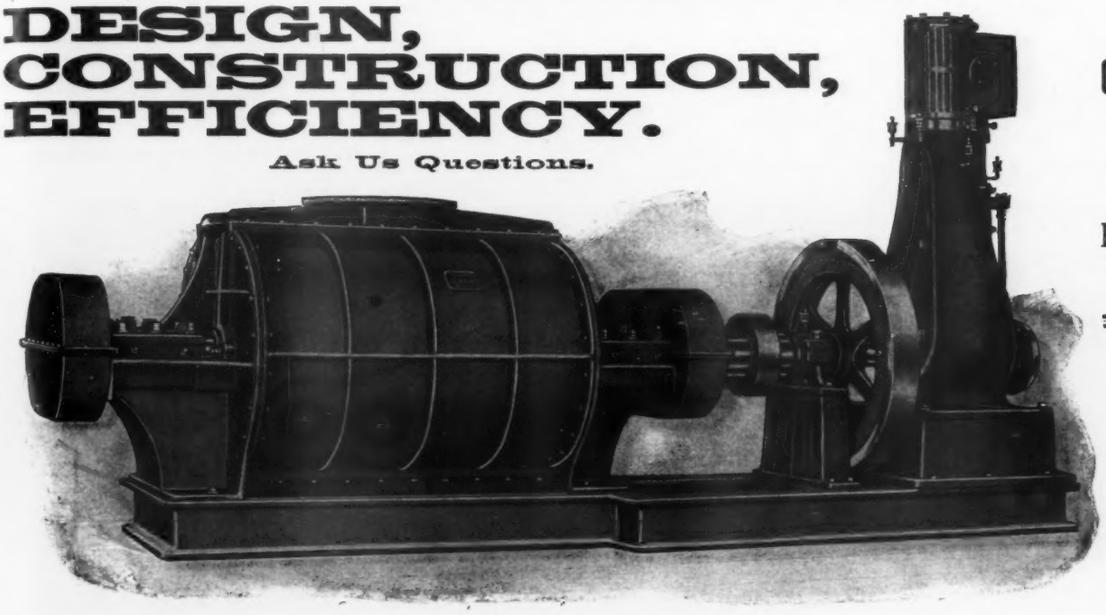

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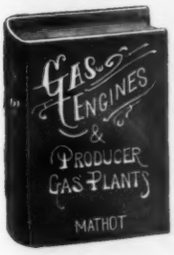

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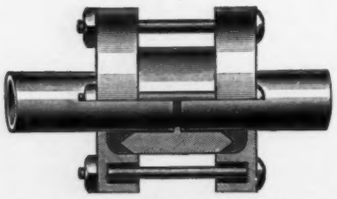

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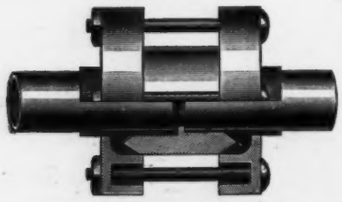

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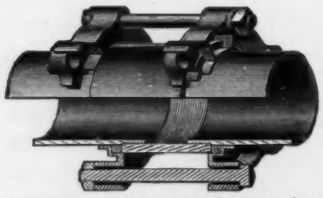

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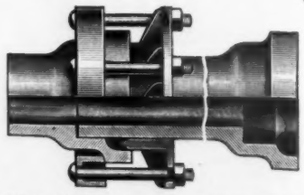
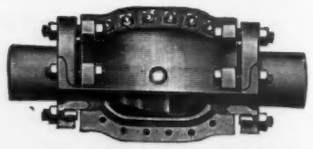
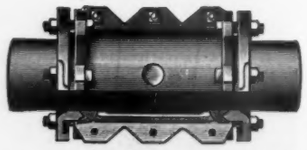


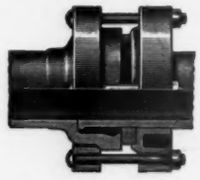
Coupling, Style 9, for Special Style Cast Iron Pipe.



Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.



Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.



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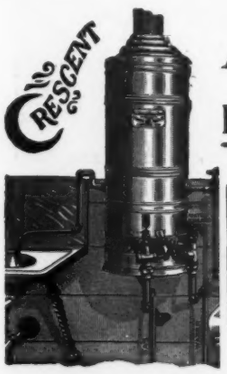

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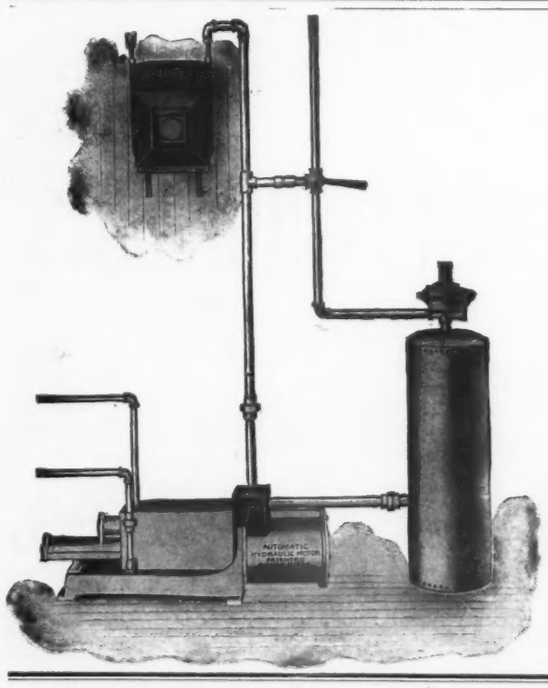

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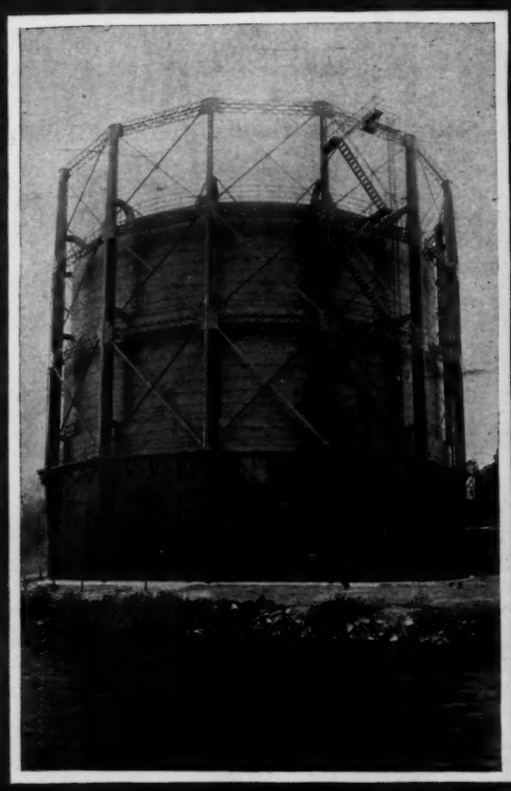

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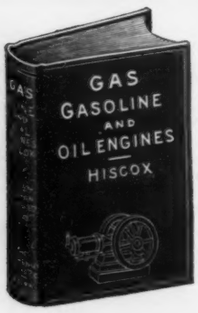

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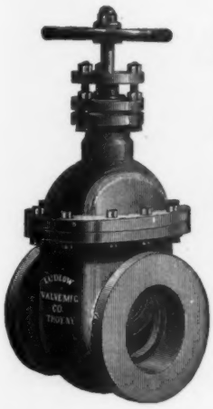

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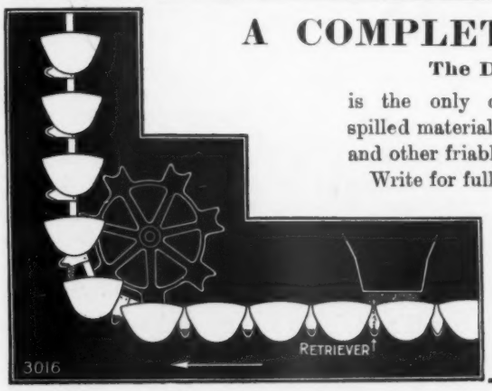

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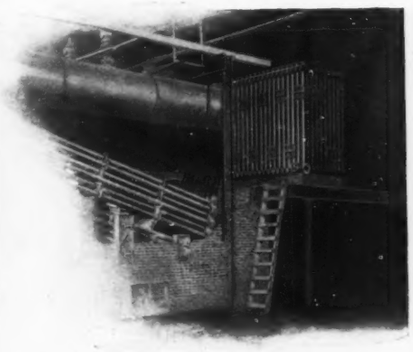

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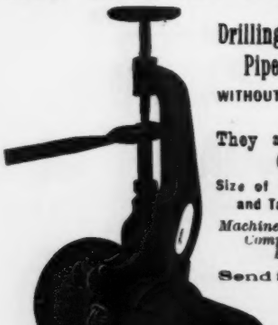

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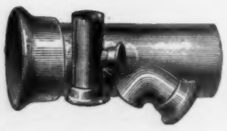

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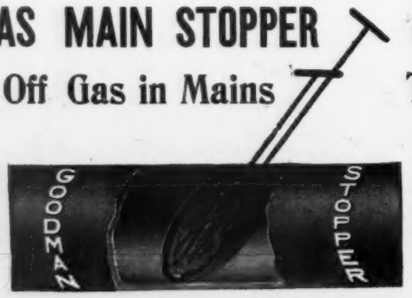

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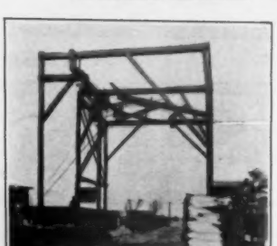

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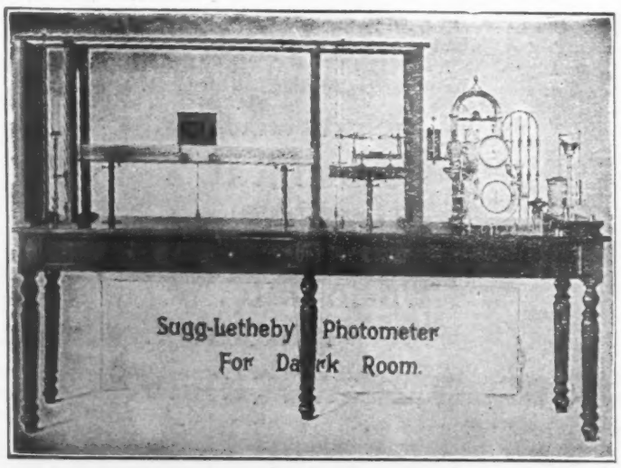
MARCH, 1906.

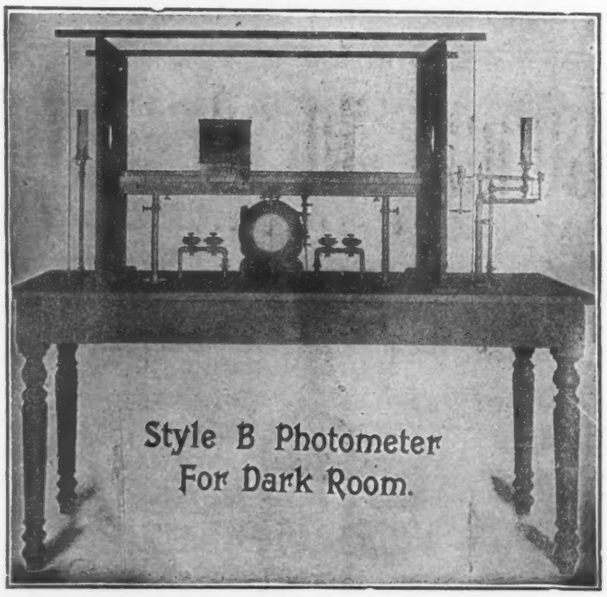
Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.
Thu.	1	11.00 PM	5.40 AM
Fri.	2	12.00 FQ	5.40
Sat.	3	12.50 AM	5.40
Sun.	4	1 40	5.30
Mon.	5	2.30	5.30
Tue.	6	3.20	5.30
Wed	7	4.00	5.30
Thu.	8	4.40	5.30
Fri.	9	No L.	No L.
Sat.	10	No L. FM	No L.
Sun.	11	No L.	No L.
Mon.	12	6.30 PM	9.20 PM
Tue.	13	6.30	10.30
Wed.	14	6.30	11.40
Thu.	15	6.30	12.50 AM
Fri	16	6.30 LQ	2.00
Sat.	17	6.30	3.00
Sun	18	6.40	3.50
Mon.	19	6.40	4.40
Tue.	20	6.40	5.00
Wed.	21	6.40	5.00
Thu.	22	6.40	5.00
Fri.	23	6.40	5.00
Sat.	24	6.40 NM	5.00
Sun.	25	6.50	4.50
Mon.	26	6 50	4.50
Tue.	27	6.50	4.50
Wed.	28	6.50	4.50
Thu.	29	9.50	4.50
Fri.	30	10.40	4.50
Sat.	31	11.30	4 50

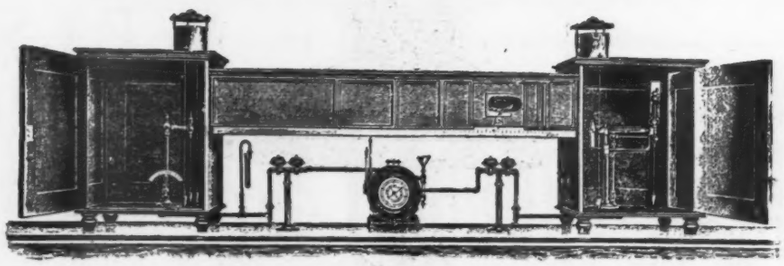
TOTAL HOURS DURING 1906.

By Table No. 1.

	Hrs.Min.
January	223.40
February	190.40
March	192.10
April	167.00
May	152.20
June	142.10
July	150.20
August	157.40
September	170.00
October	185.10
November	201.40
December	214.00
Total, yr.	2146.50







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

MARCH, 1906.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light	Extinguish.
		P. M.	A.M.
Thu.	1	5.30	5.45
Fri.	2	5.30	5.45
Sat.	3	5.30	5.45
Sun.	4	5.30	5.45
Mon.	5	5.40	5.35
Tue.	6	5.40	5.35
Wed.	7	5.40	5.35
Thu.	8	5.40	5.35
Fri.	9	5.40	5.35
Sat.	10	5.40	5.35
Sun.	11	5.40	5.35
Mon.	12	5.50	5.20
Tue.	13	5.50	5.20
Wed.	14	5.50	5.20
Thu.	15	5.50	5.20
Fri.	16	5 50	5.20
Sat.	17	5.50	5.20
Sun.	18	5.50	5 20
Mon.	19	6.00	5.10
Tue.	20	6.00	5.10
Wed.	21	6 00	5.10
Thu.	22	6.00	5.10
Fri.	23	6.00	5.10
Sat.	24	6.00	5.10
Sun.	25	6.00	5.10
Mon.	26	6.10	4.55
Tue.	27	6 10	4.55
Wed.	28	6.10	4.55
Thu.	29	6.10	4.55
Fri.	30	6.10	4.55
Sat.	31	6.10	4.55

TOTAL HOURS DURING 1906.

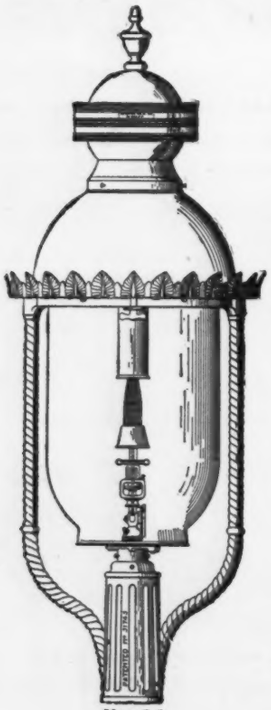
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street. BOSTON, 820 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, 218 La Salle Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

The Welsbach No. 6 Harp Fixture.

AN IDEAL LIGHT FOR DINING OR LIVING ROOMS.

THE HIGHEST MECHANICAL INGENUITY COMBINED WITH ORNAMENTAL BEAUTY--THE NEWEST OUTPUT FROM THE WELSBACH FACTORIES.

Equipped with new model No. 66 high candle power Welsbach Burner.

Side Pilot By-pass Tube covered with refractory sleeve to prevent bending.

Fourteen-inch Opal Dome Shade.

Polished Brass Embossed Crown 2¼ inches high.

Length of Fixture, 30 inches.

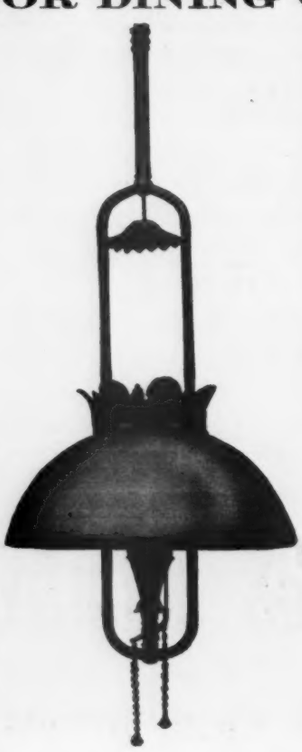
Width of Harp, 4½ inches.

Finished in Polished Brass.

Packed One Dozen to the Case.

List Price, per Dozen, $45 00.

We recommend equipping the No. 6 Harp Fixture with No. 4197 Intensive Brand Mantle, and the No. 306 **F. Q. M.** Clear Glass Air-Hole Cylinder.



Although the 14-inch Opal Dome Shade is standard equipment, we are prepared to furnish Dome Shades in green, pink or yellow (opal lined), and will be glad to quote prices.

WELSBACH CO.,

Salesrooms in all the principal cities of the United States.

Factories:

GLOUCESTER, N. J.
CHICAGO, ILL.

THE UNITED GAS IMPROVEMENT COMPANY

For the Year Ending December 31st, 1905, has been Awarded Contracts for 40 Sets of

Standard Double-Superheater Lowe Water Gas Apparatus.

PARTIAL LIST OF PLACES:

Catasauqua, Pa.
Plattsmouth, Neb.
Detroit, Mich. (2d contract).
Springfield, Ills.
Oneonta, N. Y. (2d contract).
Pottsville, Pa. (2d contract).
Evansville, Ind. (2d contract).
Lansdale, Pa.
Hempstead, N. Y. (2d contract).
New Britain, Conn.
New York, Mutual Co. (3d contract)
St. Louis, Mo. (4th contract).
Sioux City, Ia. (3d contract).
Amsterdam, N. Y.
Houston, Tex. (2d contract).
Hamilton, O. (2d contract).
Indianapolis, Ind. (2d contract).
Nanticoke, Pa.
Hazleton, Pa.
Mahanoy City, Pa.
Ludington, Mich.
Ossining, N. Y.
Lancaster, Pa.
Flushing, N. Y. (2d contract).
South Bend, Ind.
Fall River, Mass. (2d contract).
Minneapolis, Minn. (2d contract).

TOTAL SETS TO DECEMBER 31, 1905, ... 593
TOTAL DAILY CAPACITY TO DECEMBER 31, 1905, 463,780,000 CU. FT.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES, FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF

CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

ST. LOUIS GAS CONSTRUCTION CO.,

DESIGNERS AND BUILDERS OF

COAL GAS BENCHES,

SPECIAL HIGH GRADE REFRACTORY MATERIAL FOR BENCH SETTINGS AND WATER GAS LININGS.

SOLE AGENTS FOR

CHRISTY SETTINGS.

CORRESPONDENCE SOLICITED.

ST. LOUIS, MO.

FIELD'S ANALYSIS FOR THE YEAR 1904.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 36th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by

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Established 1846.

Adam Weber Sons.

Manhattan Fire Brick and Enameled Fire Clay Retort Works.

Works at Weber, on the Raritan River, Middlesex County, New Jersey.

GENERAL OFFICES:
Park Row Building, New York City.

Modern Coal Gas Benches,

With either Horizontal or Inclined Retorts, Half-Depth and Full-Depth Recuperative Furnaces.

ADAM WEBER PATENTS

STANDARD BENCH IRONWORK.

Linings for Water Gas Apparatus, High Grade Fire Brick of All Shapes and Sizes, Ground Fire Clay, Ground Fire Brick in Bulk or in Barrels.

ISAAC C. BAXTER, President.
Works.
LOCKPORT STATION, PA.

ESTABLISHED 1864.

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Successor to WILLIAM GARDNER & SON.

PETER YOUNG, Secretary and Treas.
Address all communications to
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PITTSBURGH, PA.

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

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In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD,
1200 Bank for Savings Bldg., Pittsburgh, Pa.

NATIONAL PYROGRANIT COMPANY,

MANUFACTURERS OF

Fire Brick, Tiles, Special Shapes, etc.

NEW YORK OFFICE:
17 Battery Place, New York.

WORKS:
South River, N. J.

ESTABLISHED 1868.

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BALTIMORE RETORT & FIREBRICK CO.

BALTIMORE, MD.,

Manufacturers of all Material for the Construction of Coal Gas Benches.

HALF AND FULL DEPTH AND FREE FIRING BENCHES,

All styles of which we have in operation, equipped with the BEST of LATEST IMPROVEMENTS, proving our claim for SUPERIOR QUALITY and EFFICIENCY.

INCLINES—We have in SUCCESSFUL OPERATION benches of Inclined Retorts, MANUFACTURED and ERECTED by us.

WALDO BROS., 102 MILK ST., BOSTON, MASS.,
Agents for New England States.

LARGE FACILITIES—Correspondence Solicited.
RAIL and WATER CONNECTIONS to ALL POINTS.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

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Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the **Exclusive Agents** *for the* **Mitchell Patent Benches,** *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* **Rear Clinkering.** *The* **Mitchell** *is the* **Original Coal Firing Bench.** *We also Erect Plain Benches with* **One** *to* **Six Retorts.**

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

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Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada.

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These are the only machines that will draw or charge simultaneously 3 or 4 retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Canada, working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins, a Specialty.

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229 BROADWAY, NEW YORK.

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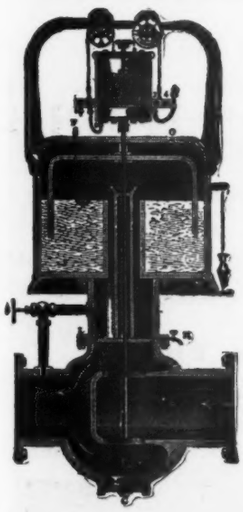

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COAL OR WATER GAS PLANTS,

Automatic, Balance, High Pressure and Service Governors,

Roots Improved Gas Exhausters,

Iron Sponge, Purifying Material for Gas Purification, Jones Jet Photometers, Pressure Registers, etc.,

INSTALLATION OF SMOKELESS TAR BURNING SYSTEM,

Reinforced Concrete Construction for all Purposes,

Wide Experience in High Pressure Installation and Extension,

GAS SPECIALTIES.

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295 West 22d Street, CHICAGO, ILLS.

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OAK HILL GAS RETORT AND FIREBRICK WORKS.

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WE MAKE A SPECIALTY OF WATER GAS LININGS AND CHECKER BRICK.

Half and Full Depth Benches of Our Own Design, Containing 6, 8 or 9 Retorts.

SLOPERS.—We have perfected plans of **INCLINED RETORT BENCHES,** designed to meet conditions prevailing in America, and constructed entirely of American materials.

We Build Benches Complete. Ready for Gas Making. Also,

RETORT HOUSES,

COAL and COKE CONVEYING MACHINERY.

Plans, Specifications and Estimates Cheerfully Furnished.

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Gold Medals awarded by the Louisiana Purchase Exposition at St. Louis, for fireclay gas retorts, gas retort benches, firebrick and setting tiles.

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Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

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Offices:
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STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming.

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SUPPLANTED BY JEFFREY MACHINERY,

DUMP CARS for ASHES,
ELEVATORS AND CONVEYORS for COAL,
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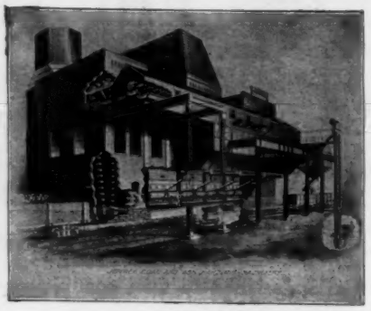
Elevator Buckets,
CHAINS of ALL KINDS.



Which REDUCES LABOR TO A MINIMUM and LESSENS EXPENSE.
CABLE, SPIRAL & RUBBER BELT CONVEYORS.
Coal and Coke Crushers.
SCREENS of ALL KINDS.

COAL storage capacity, 1,000 tons.

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For Students in Gas Manufacture.
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ENGINEERS AND BUILDERS OF GAS PLANTS.
Inclined Benches, own system, Recuperative Furnaces, Exhausters, Exhauster Governors, Condensers, Washers, Coolers, Wet Purifying Plants, Purifiers, Oxide Elevators, Hydraulic and Dry Coke Conveyors.
Special High Grade Material for Recuperative Furnaces.
Licensees for ARROLL-FOULIS Charging and Discharging Machines and FRONHAUSER Coke Conveyors. OFFICE, 405 KEENE ST., MILWAUKEE, WIS.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

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THE SUN OIL CO.

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Refined Oil, Lubricating Oils.

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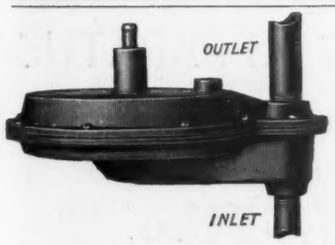

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Our Governors Reduce 30 or 40 Pounds Pressure to 2 Inches Water Pressure.

WE MAKE ALL SIZES OF

DOUBLE DISTRICT GOVERNORS, INDIVIDUAL HOUSE SERVICE AND LOW PRESSURE GOVERNORS.

Write for Catalogue and State what you Need.

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With Instructions for Care and Working of the Same,

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Translated with Permission of the Author, GEO. M. RICHMOND, M.E.

PRICE, $1.00.

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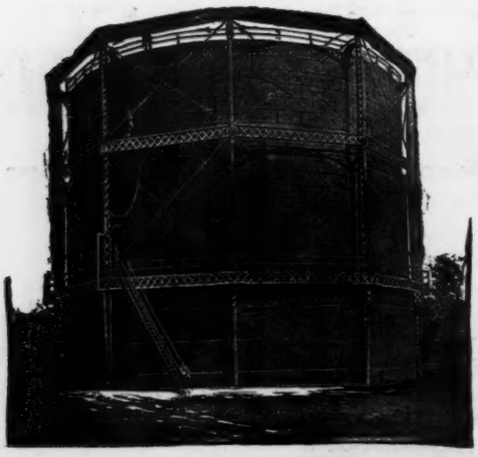

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Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

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SINGLE AND DOUBLE-LIFT GASHOLDERS AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

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THE GAS ENGINEER'S POCKET-BOOK,

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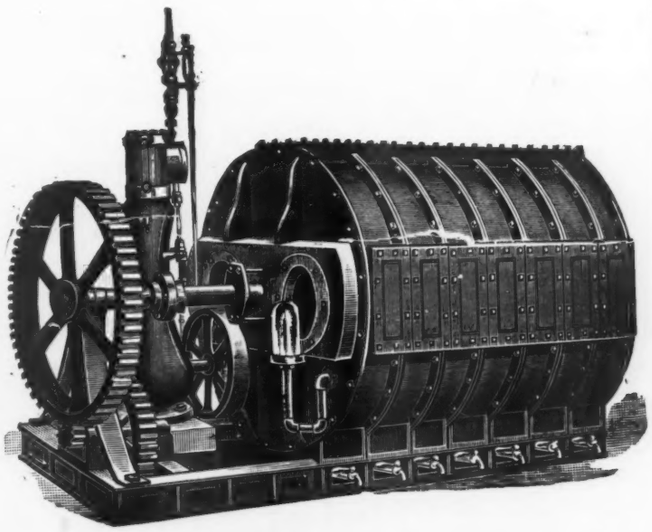
Designers and Builders of Gas Works.



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The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Disks, thus reducing the weight on shaft and power for operating same.

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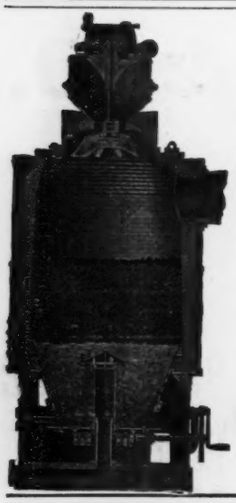
COMPLETE EXAMINATIONS MADE.
PROPERTIES PURCHASED.



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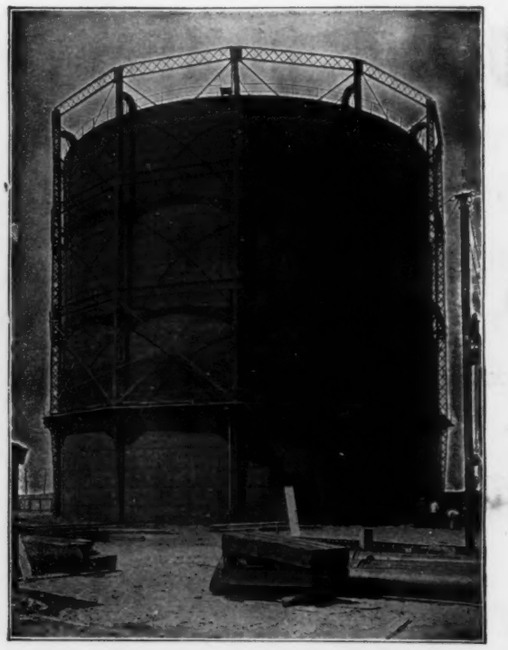

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Dear Sir: I am in receipt of a copy of "Excerpts from the Decisions of the Board of Gas Commissioners," which is a handy compilation in book form of extracts from the most recent decisions of the Gas Commission of Massachusetts.

I note that most of these extracts are broad and safe-guiding precepts, which apply with equal force to one Company as to another. The 13 years' existence of the Board of Gas Commissioners, with its unusual opportunities for acquiring information, have justly made it a high and safe authority in all matters pertaining to the management, obligations and rights of Gas Companies. Your little book will serve as a valuable reference library in settling legal complications which often arise between a Gas Company and its customers.

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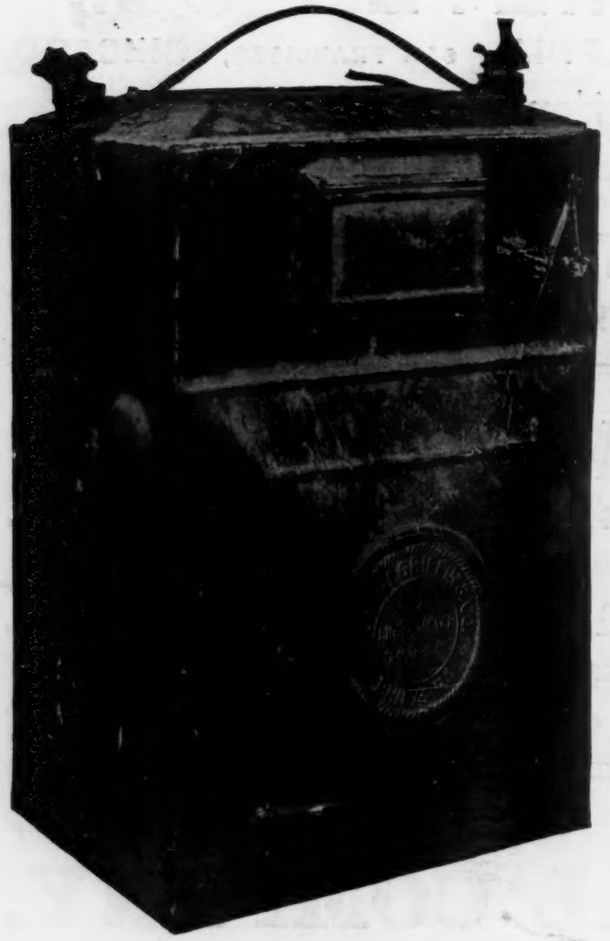

This is a photograph of a 3-light regular meter out of a lot of meters received from the Coatesville Gas Co., Coatesville, Pa., to be repaired and converted into prepayment meters.

AFTER.

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